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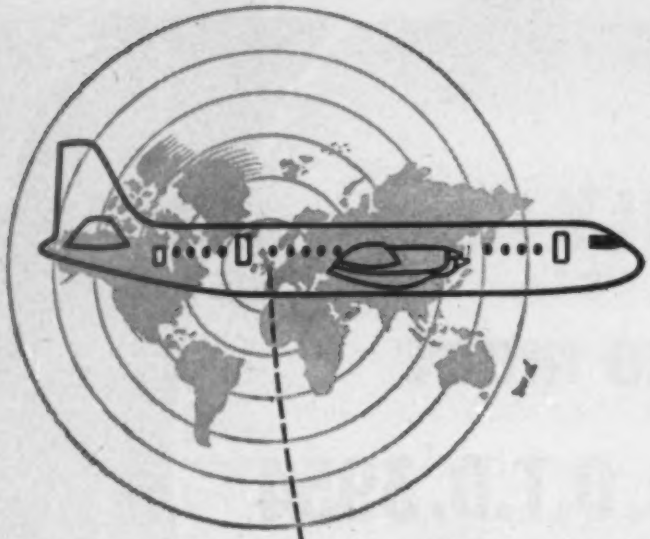

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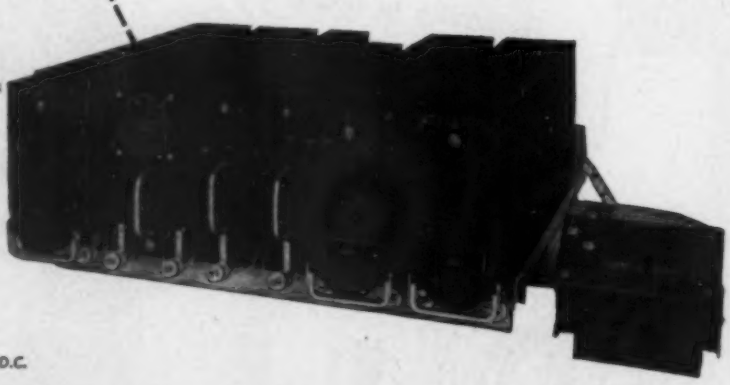

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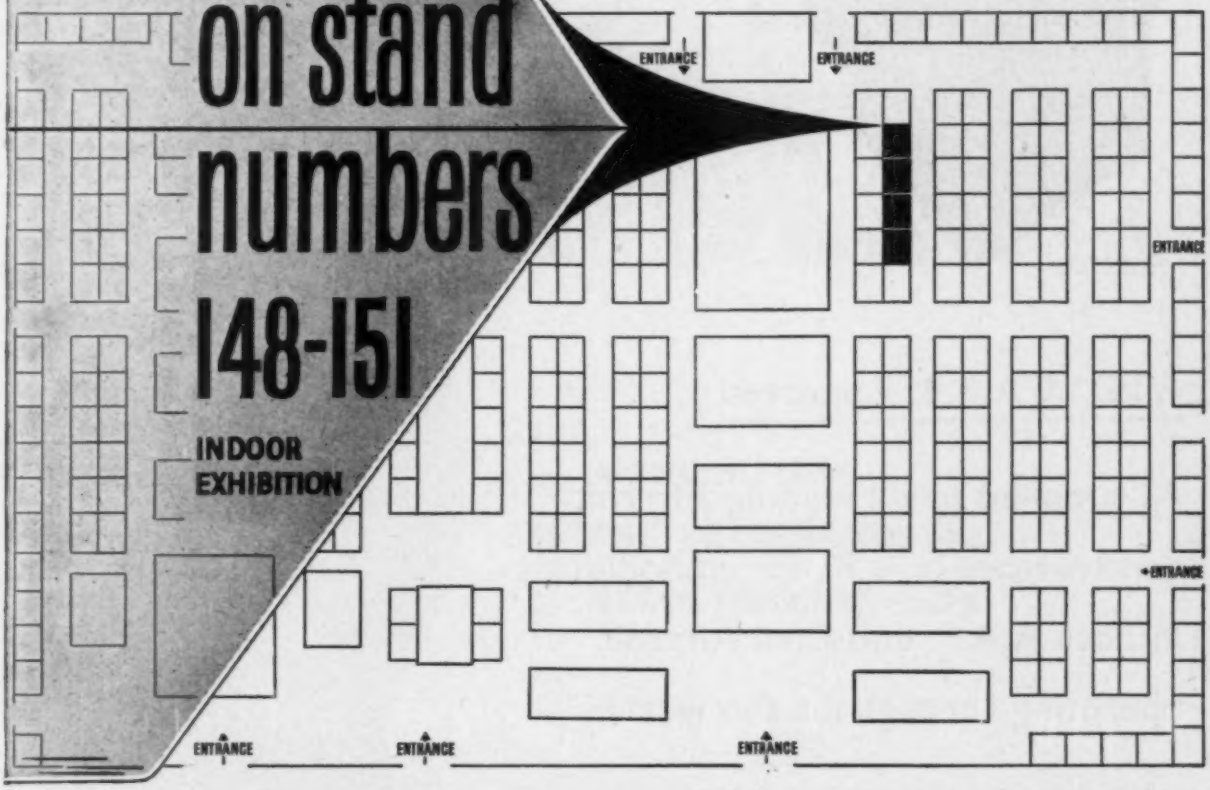

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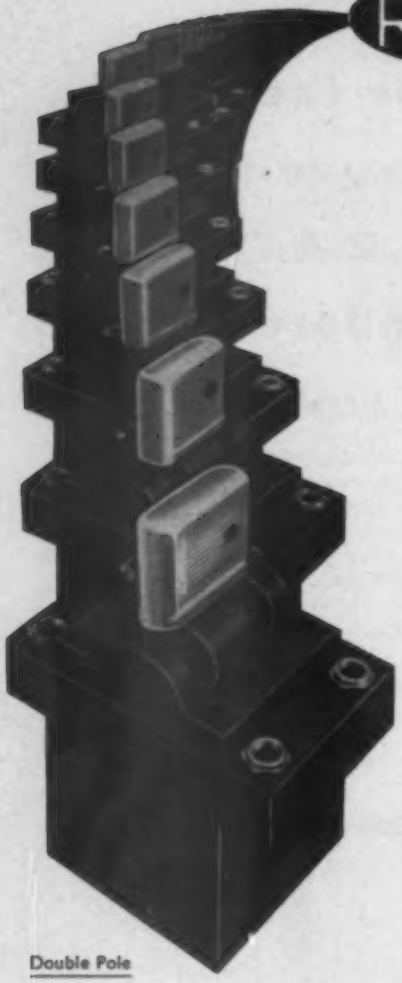

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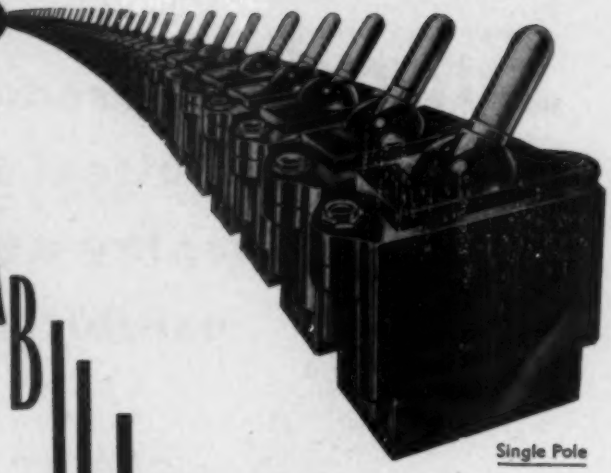

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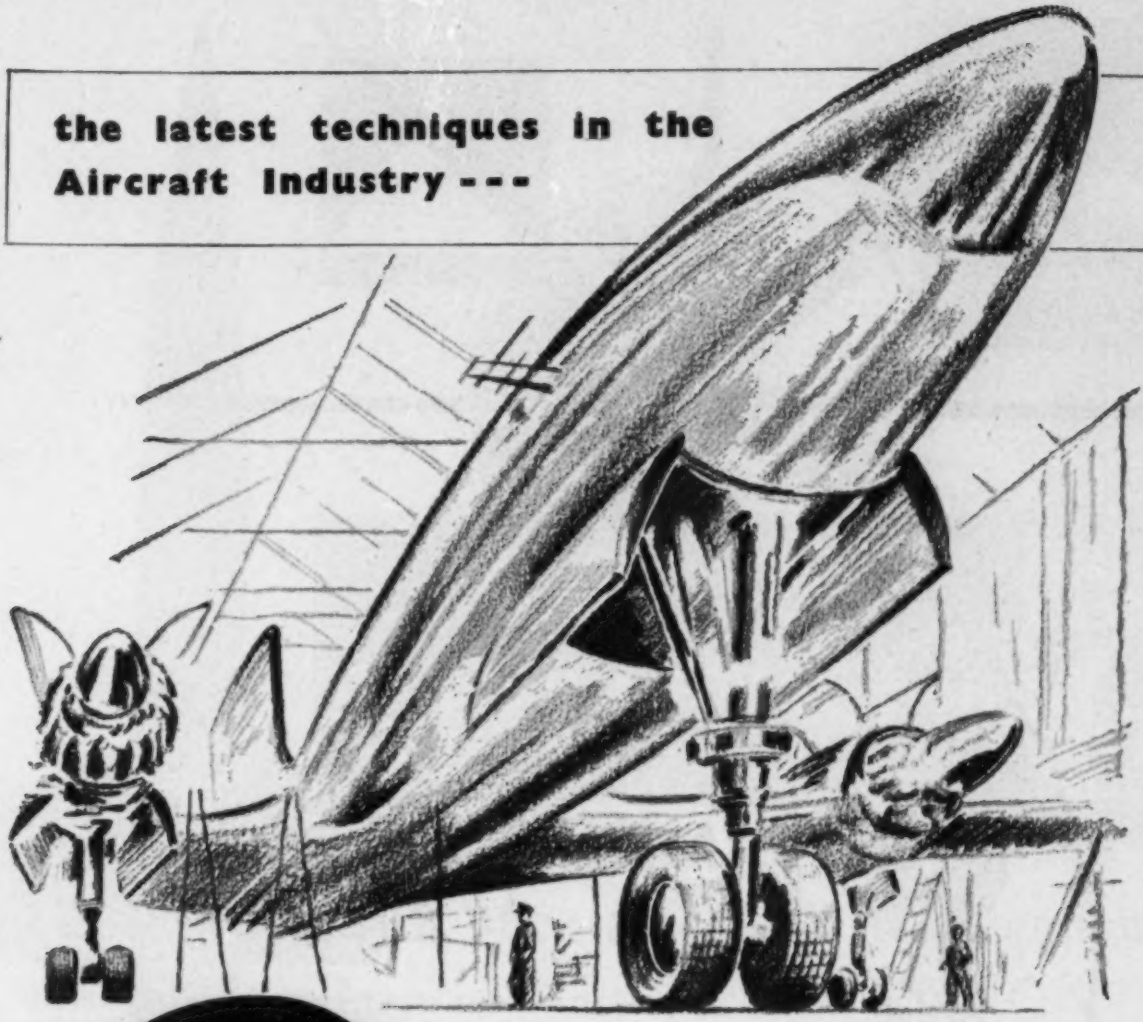

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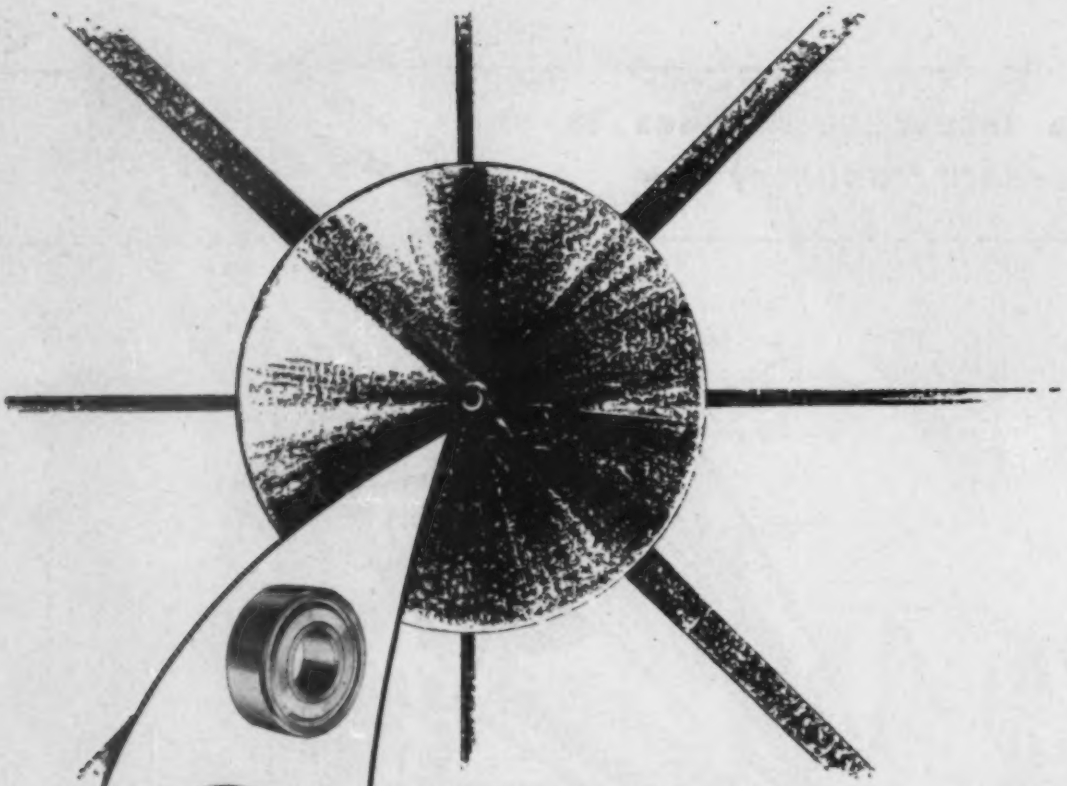

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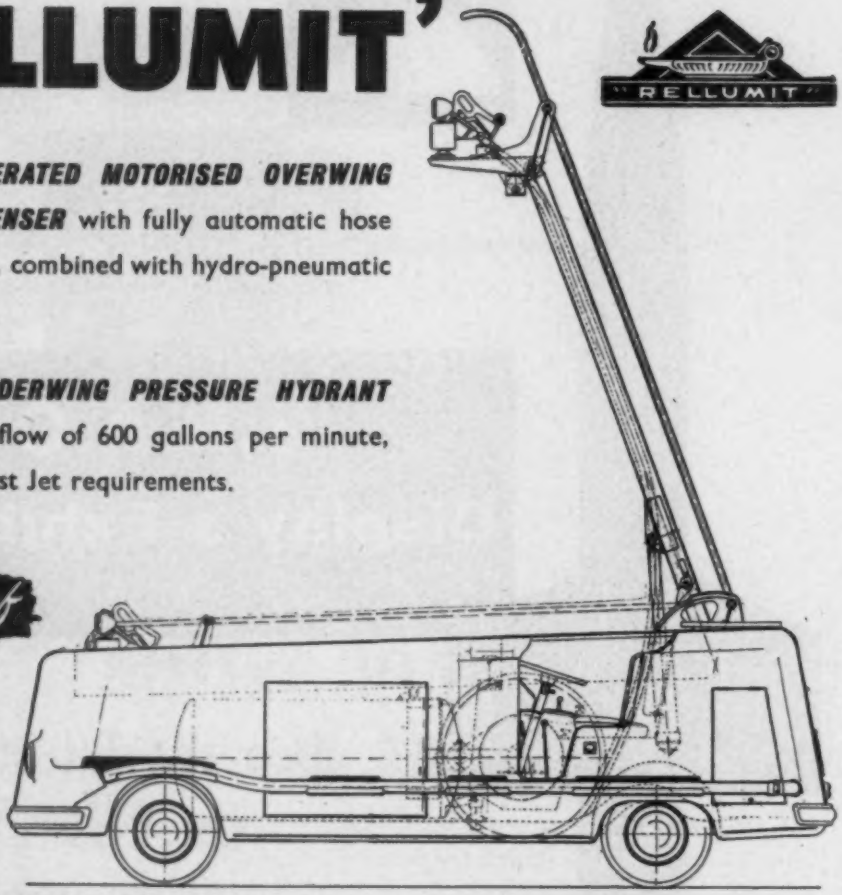

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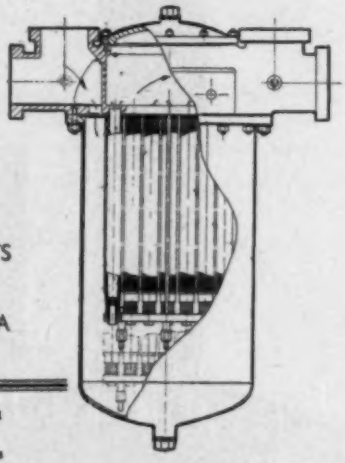

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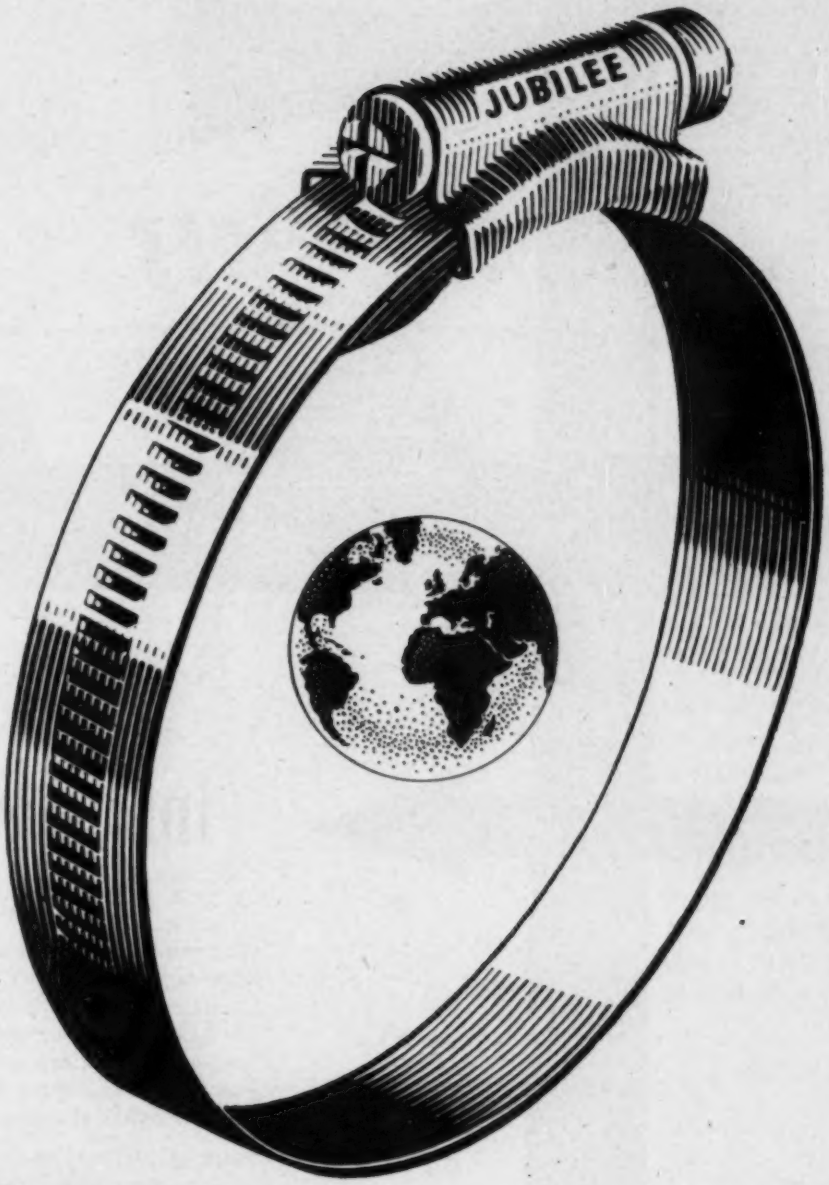

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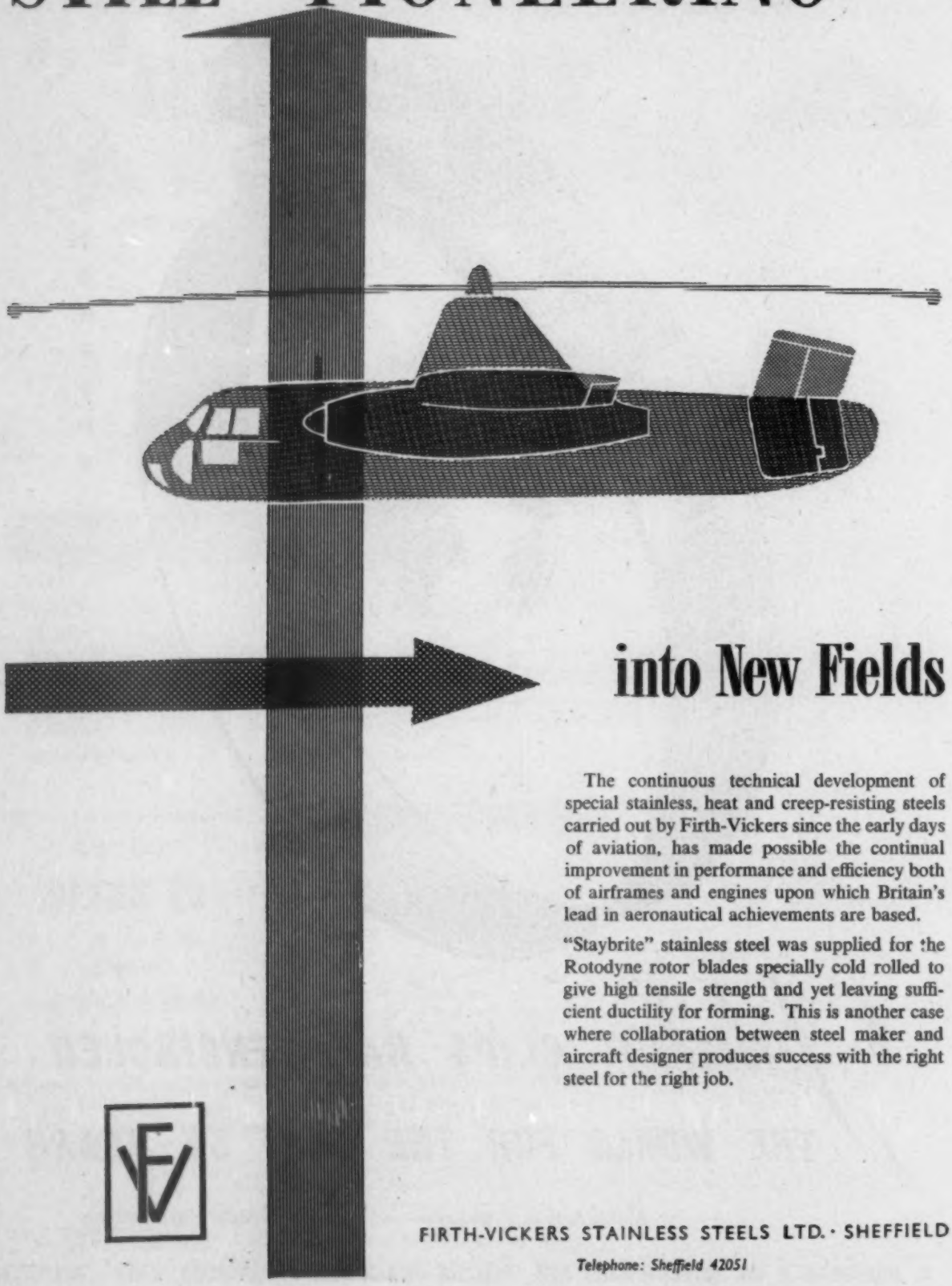

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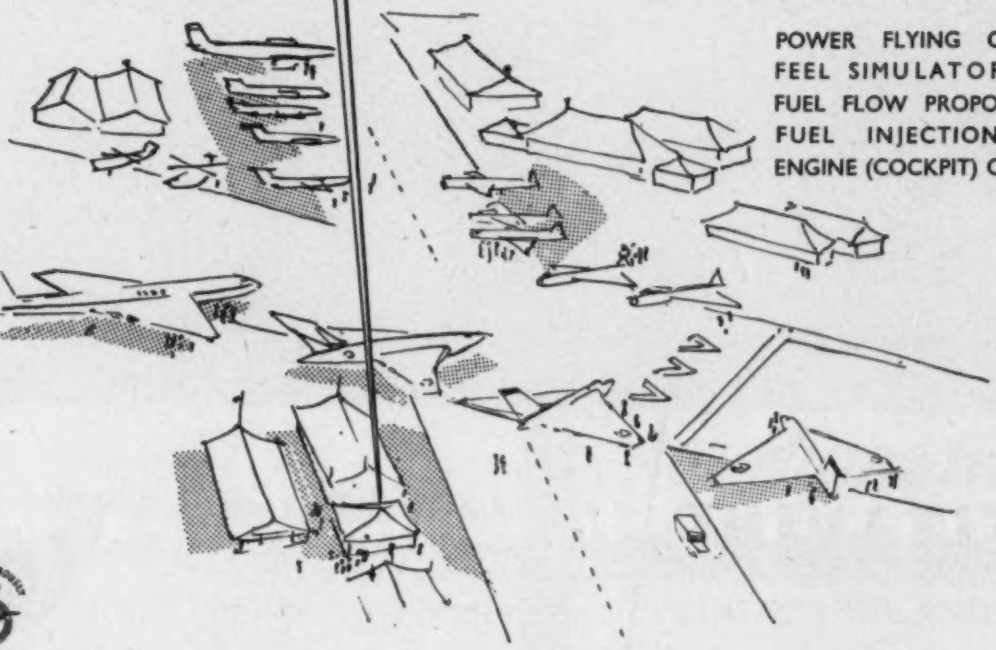

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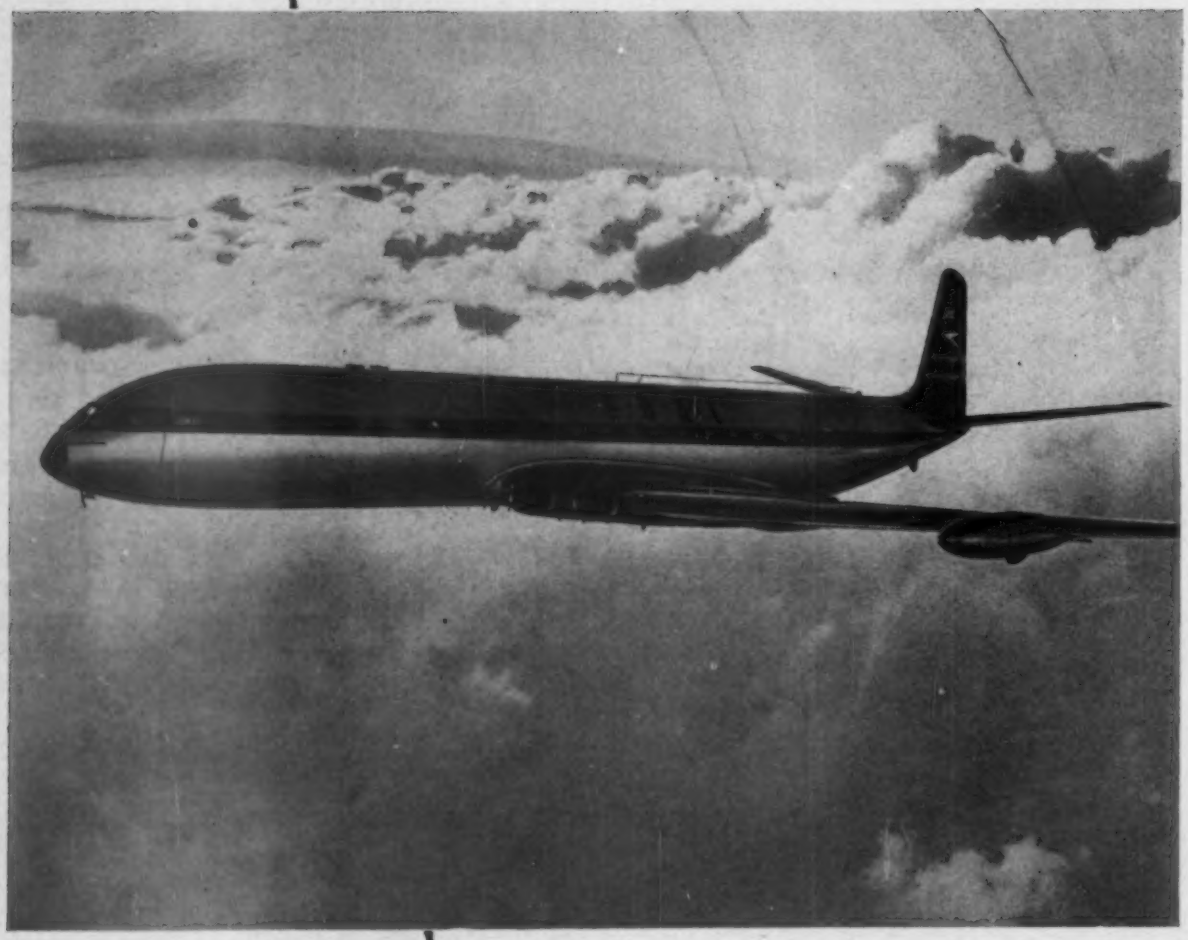

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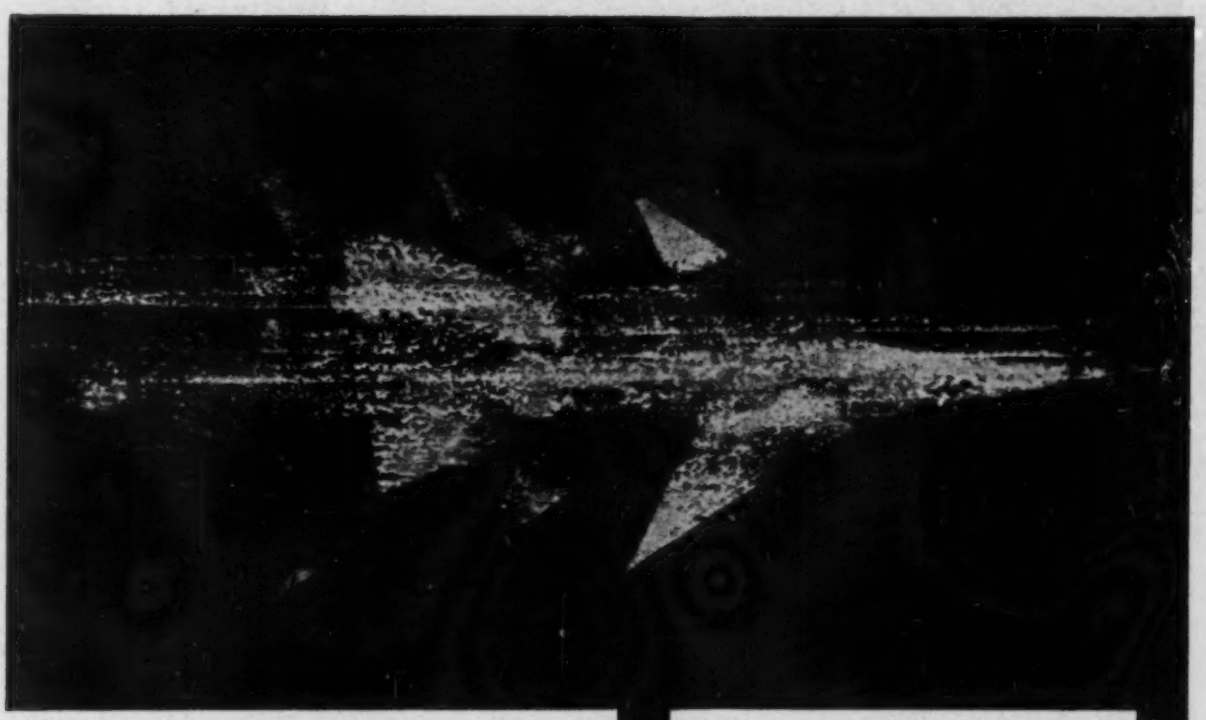

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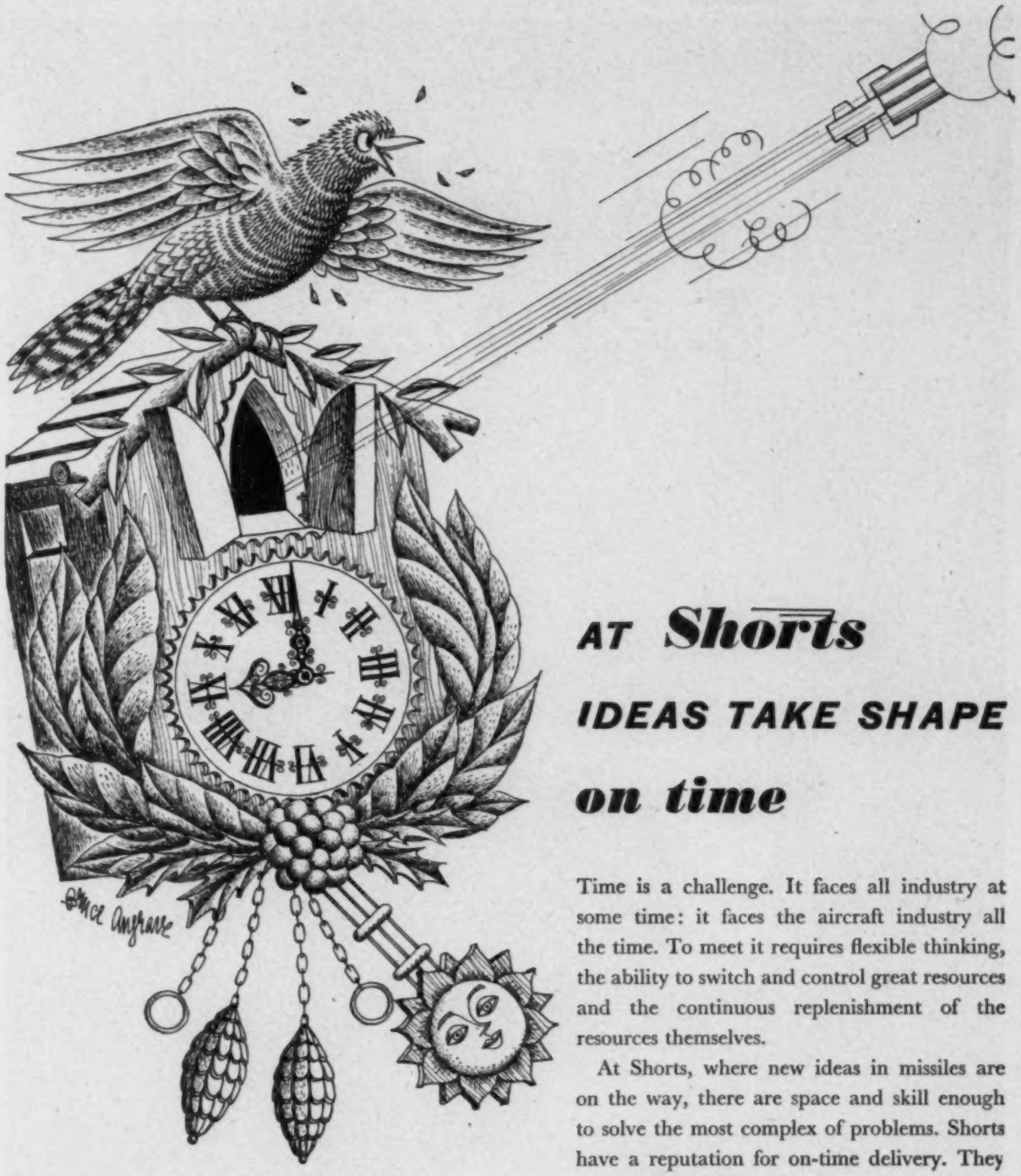

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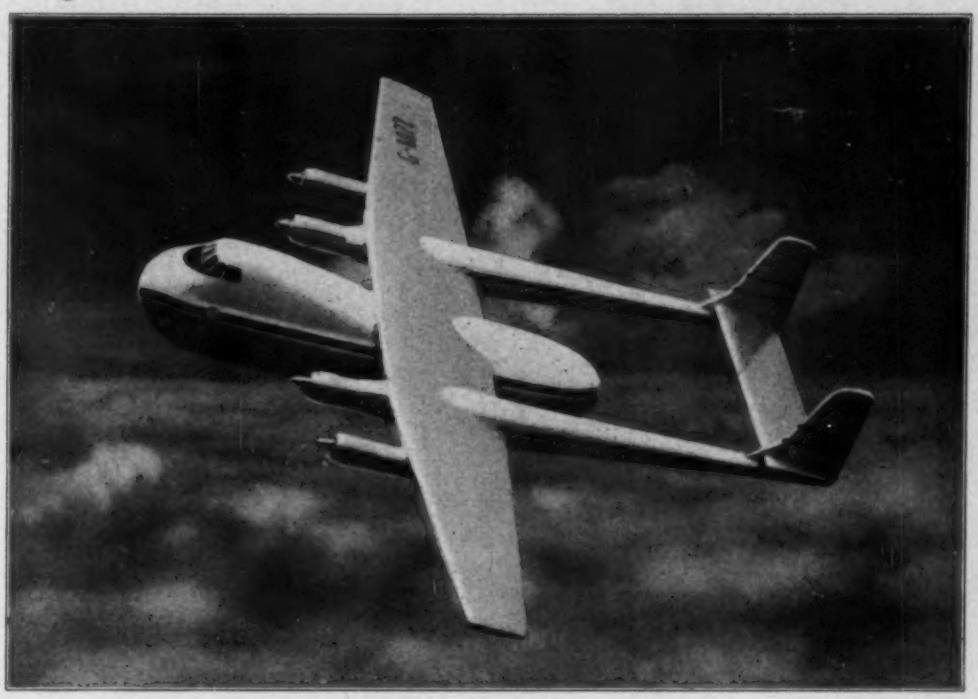

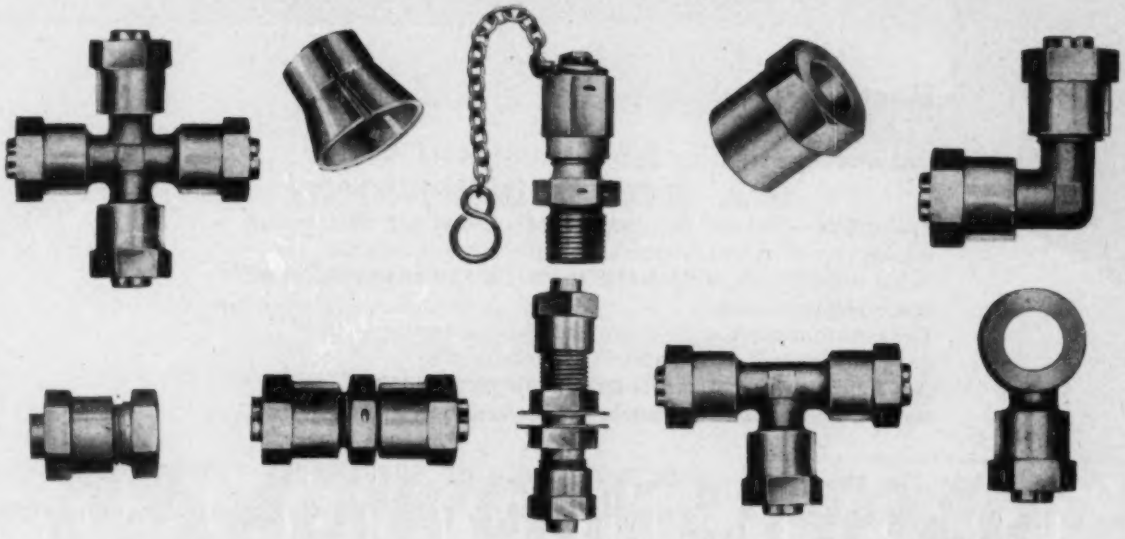

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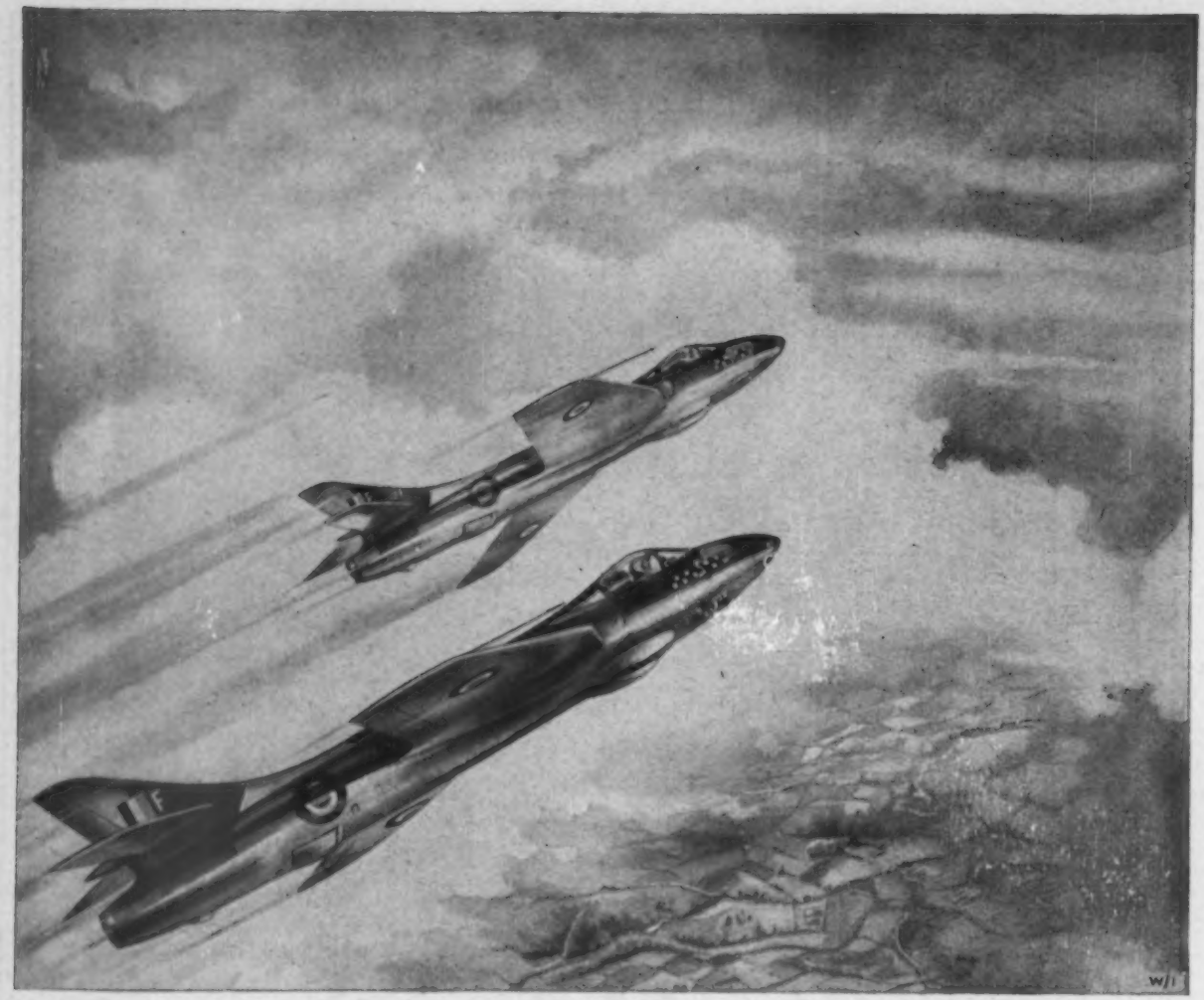

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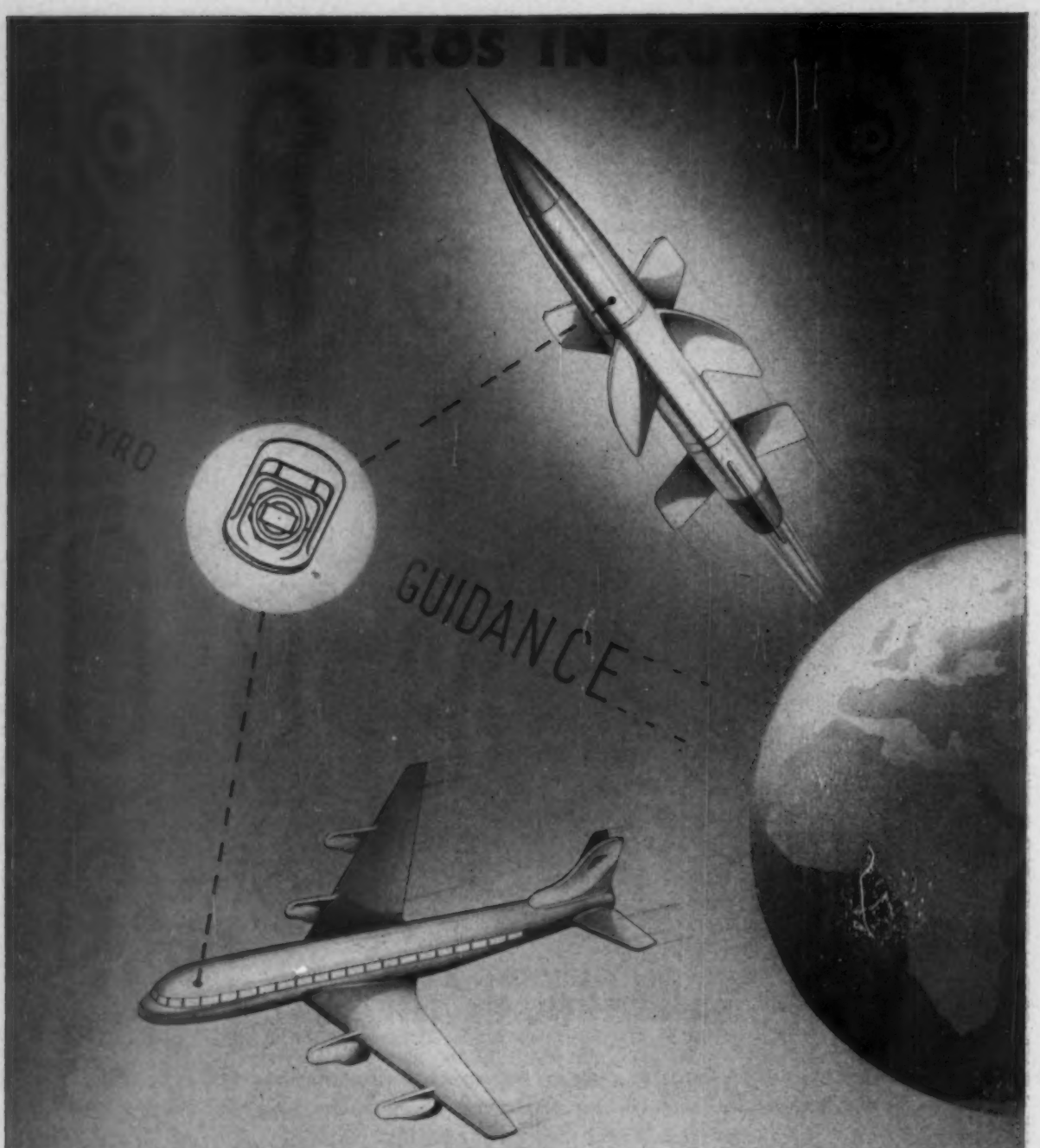

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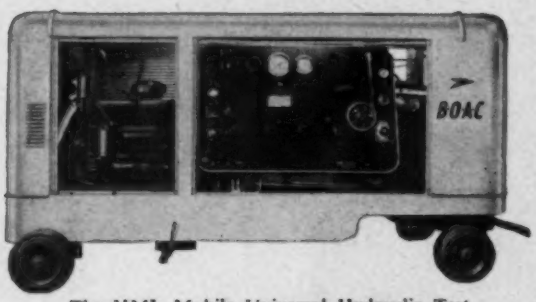

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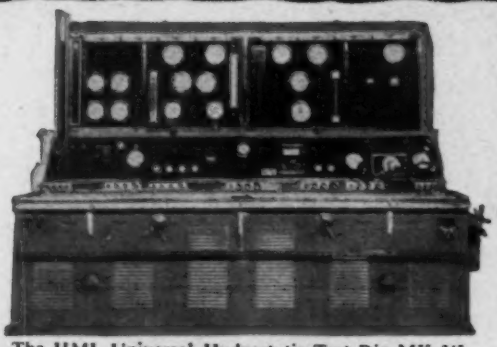
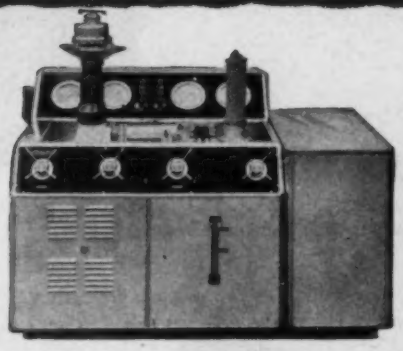


The HML Universal Hydrostatic Test Rig MK XI provides bench testing for all hydraulic components and aircraft pumps.



The HML Universal Propeller Component and Hub Test Bench. Designed to deal with propeller valve and hub assemblies, is universal in pressure and flow range and can be pre-set to test various propeller components.

HML EQUIPMENT INCLUDES:

Universal Hydraulic Test Rigs, Mk. II and Mk. III (Diesel or Electric Powered)
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Aircraft Pump and Hydraulic Motor Test Rig
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Brake Test Unit
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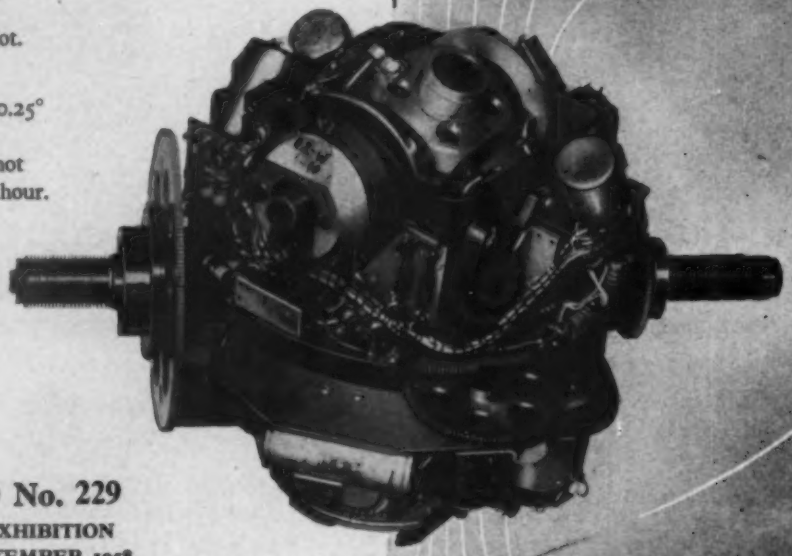

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AP193

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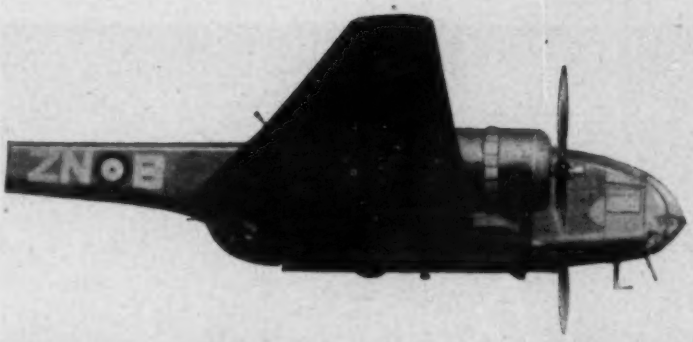

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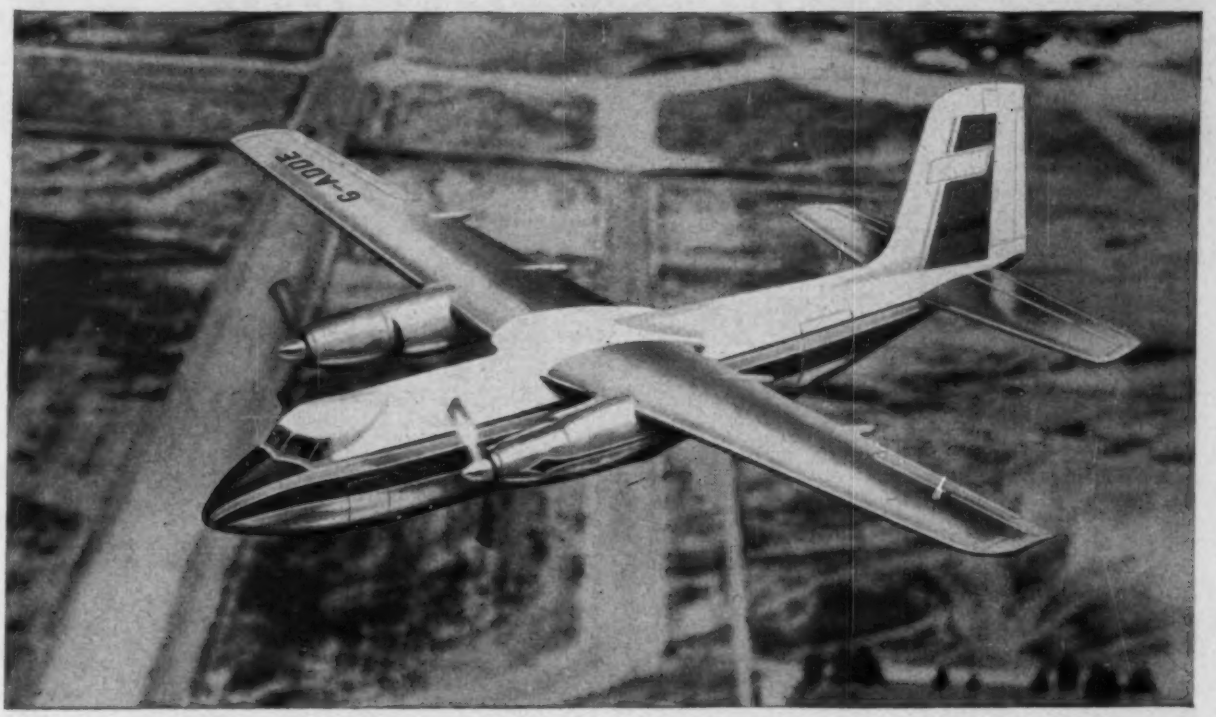
TO HERALD



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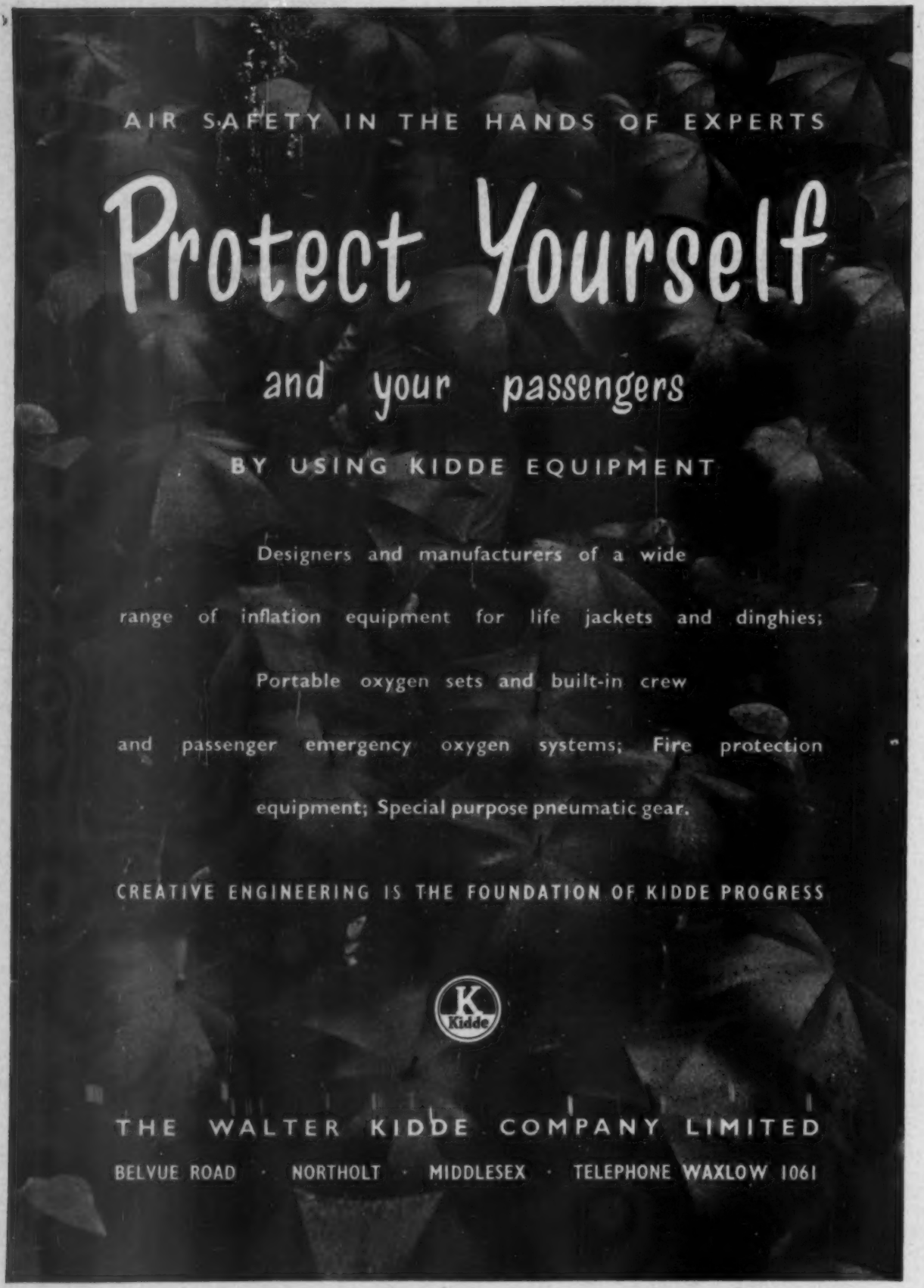
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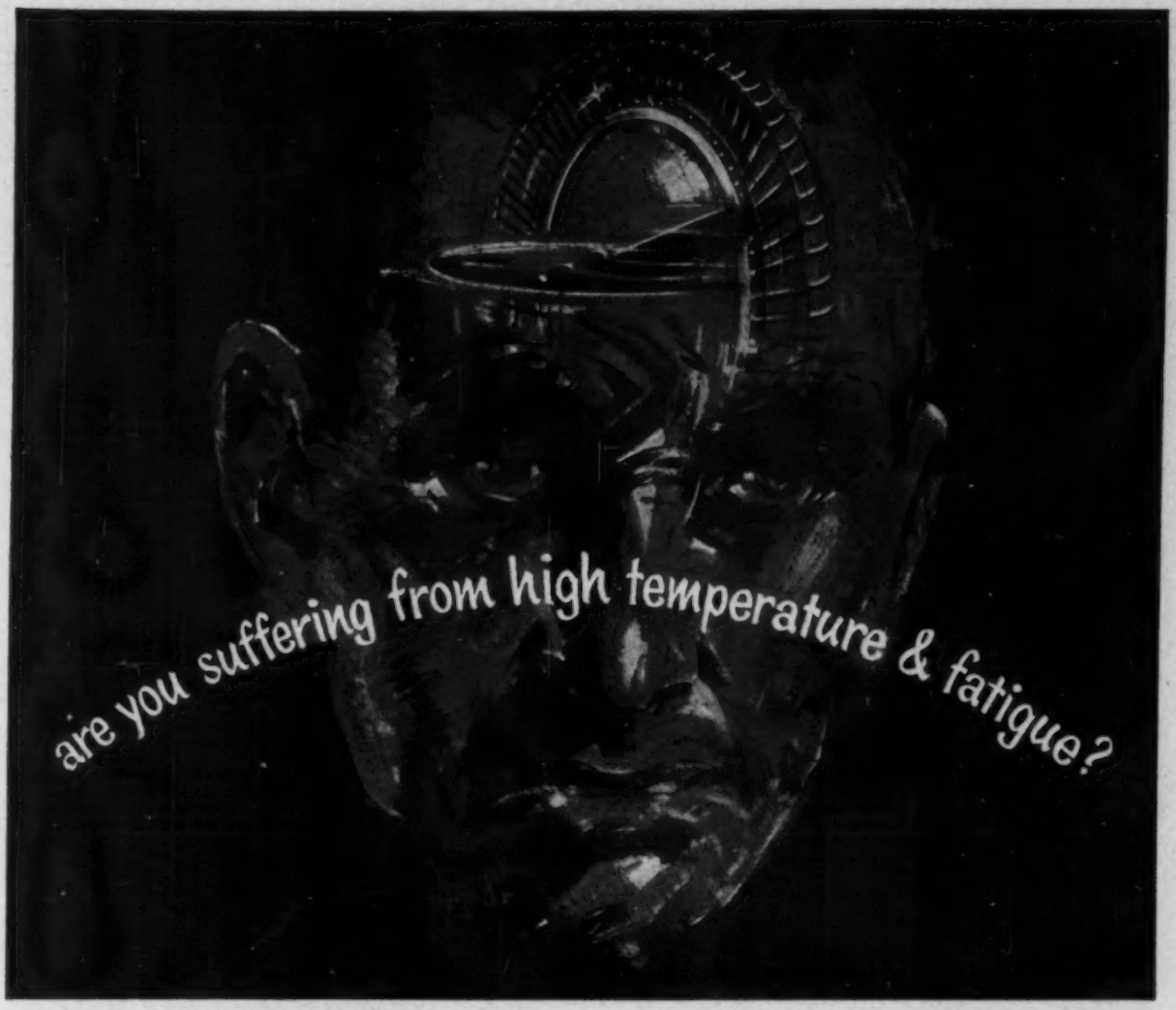

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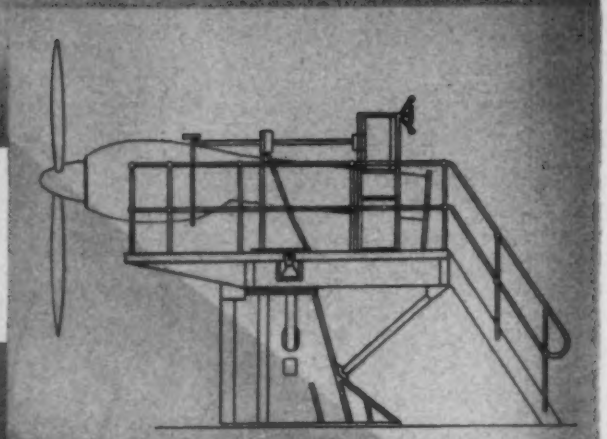

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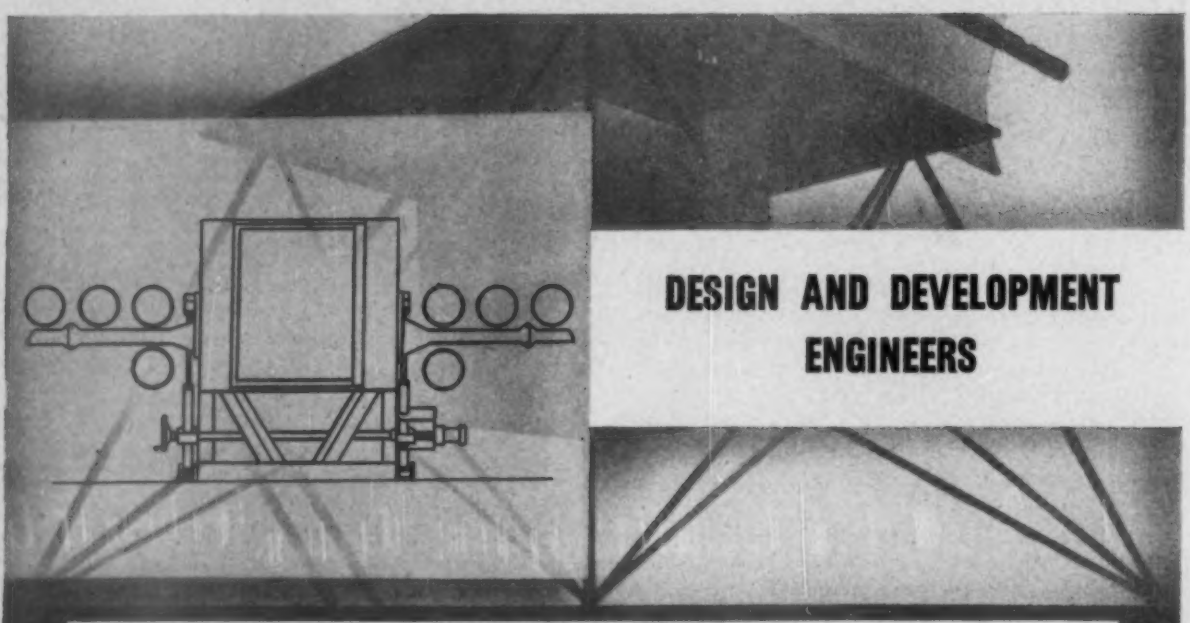

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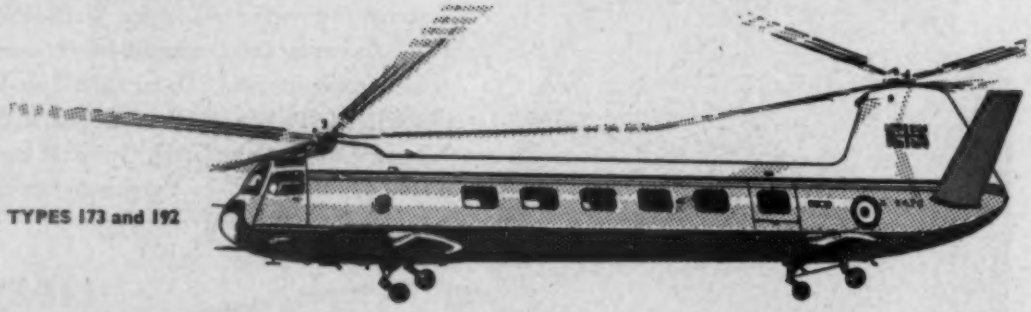

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AP 85

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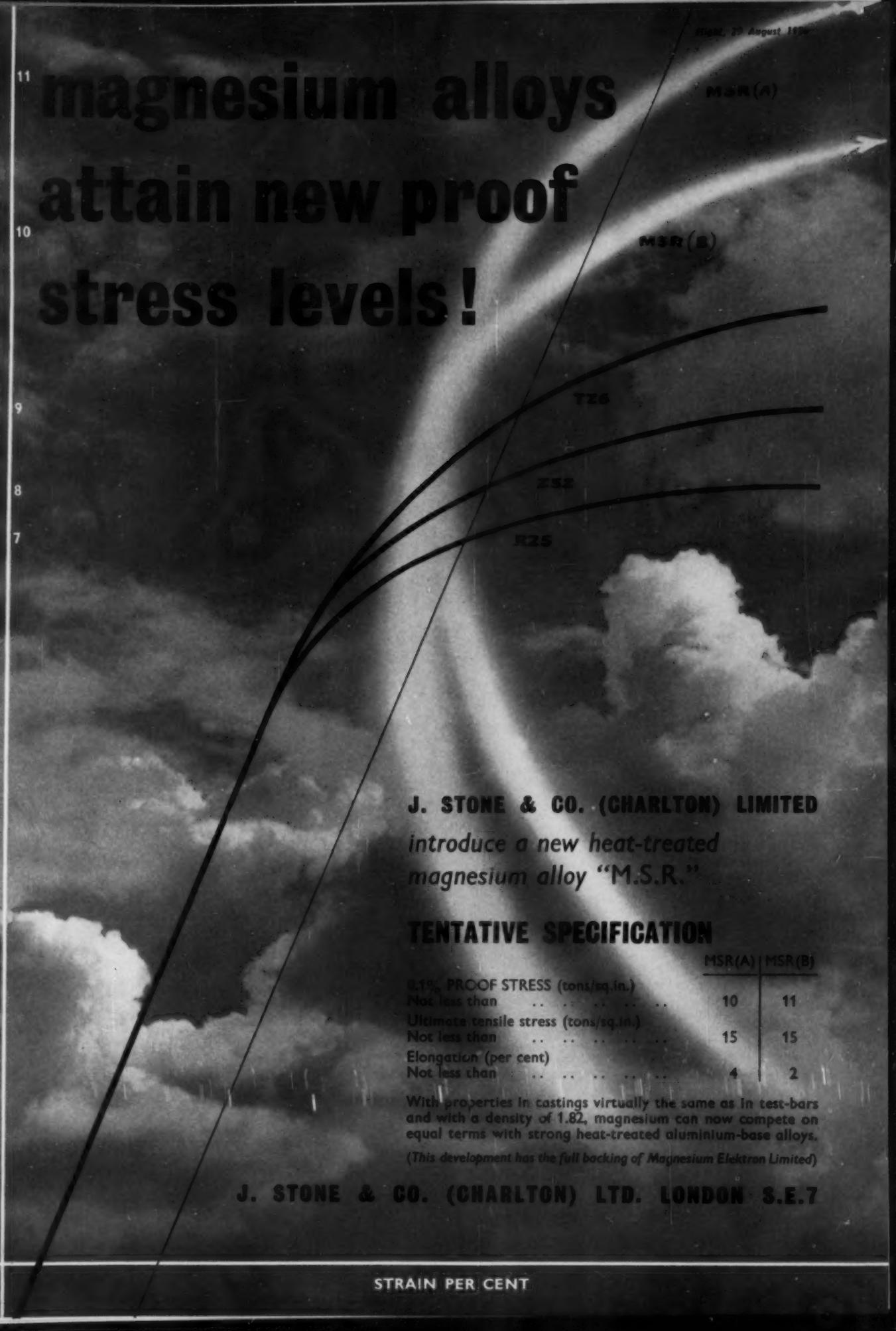

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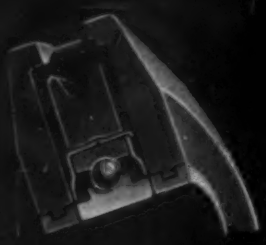

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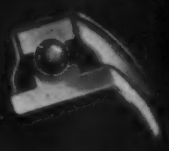
Single Row Self Aligning with Shields

Double Row Pulley Bearing with Housing and Shield

Ball Bearing Pulley

Double Row Self Aligning

Single Row with Shields



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S.B.A.C. EXHIBITION STAND 243

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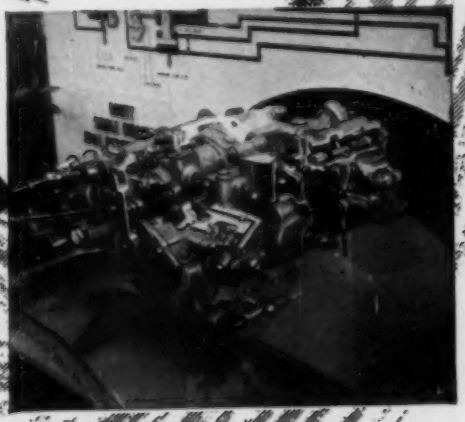

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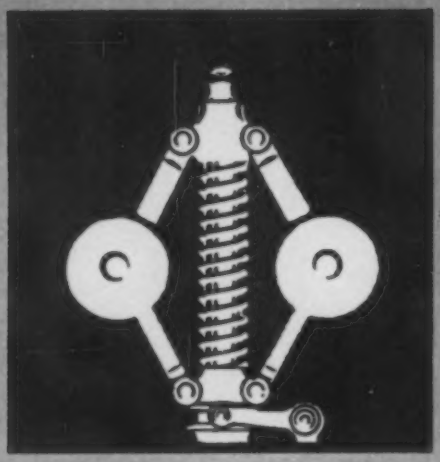

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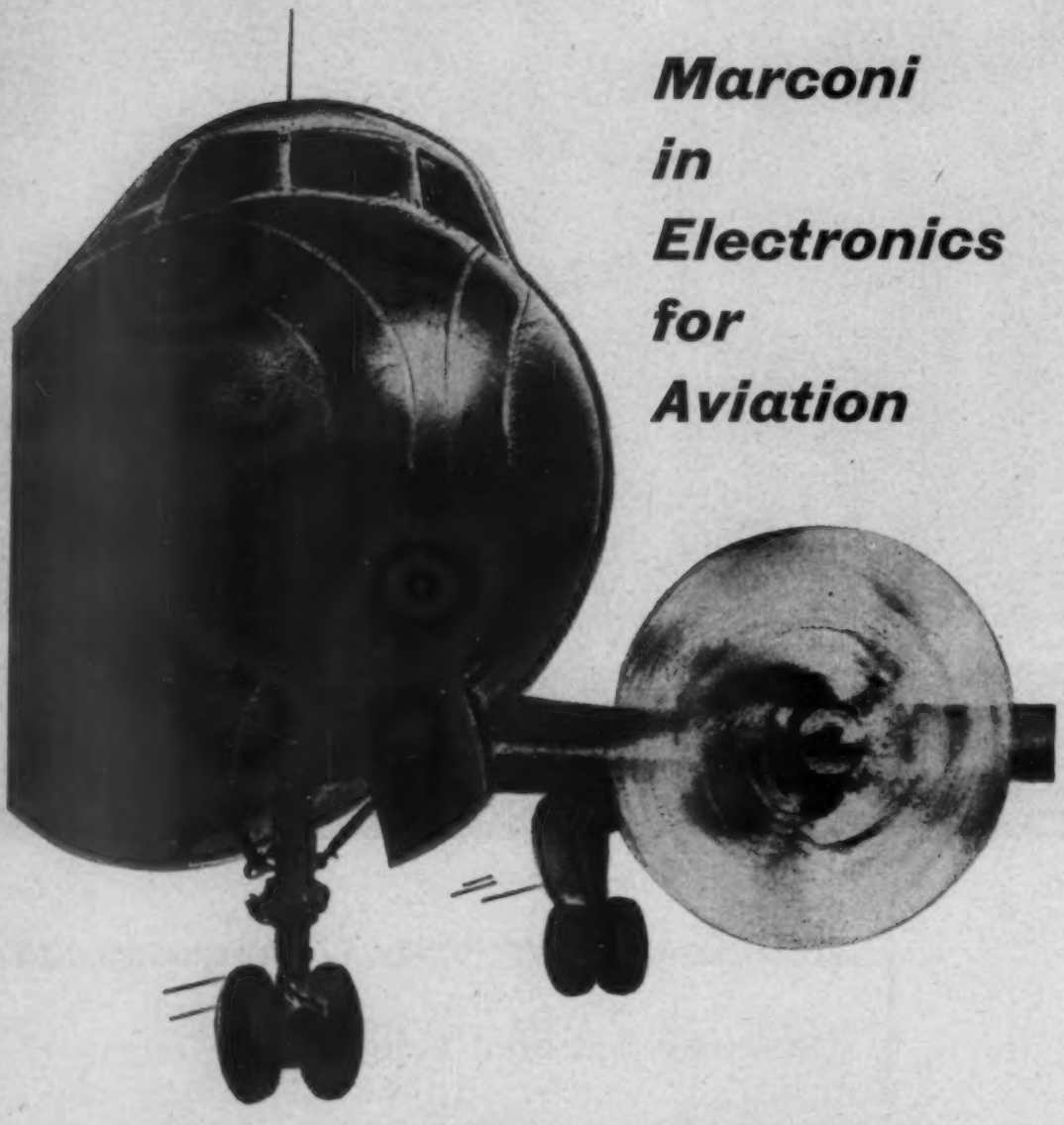

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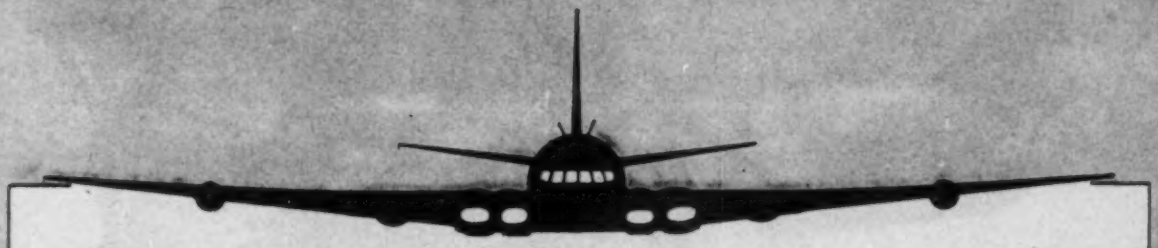

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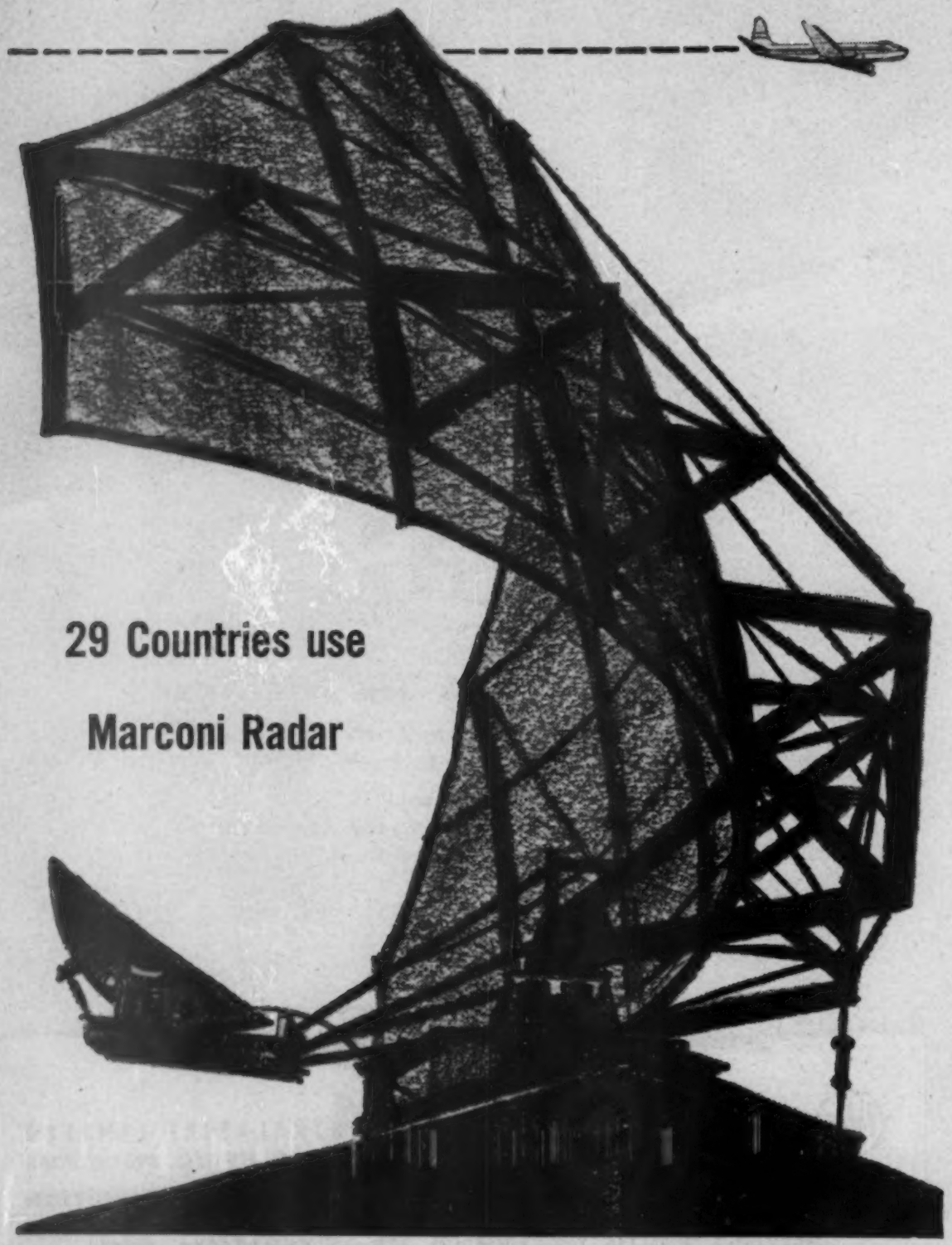

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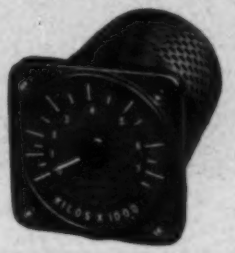

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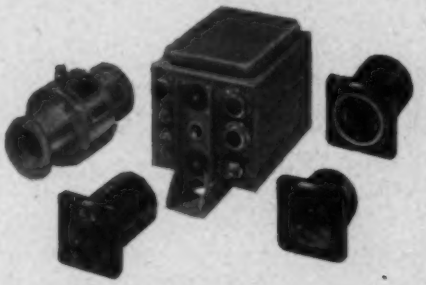

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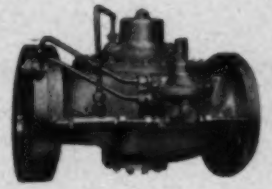

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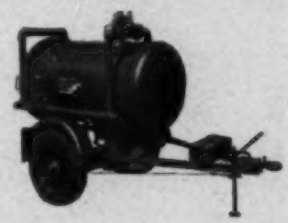

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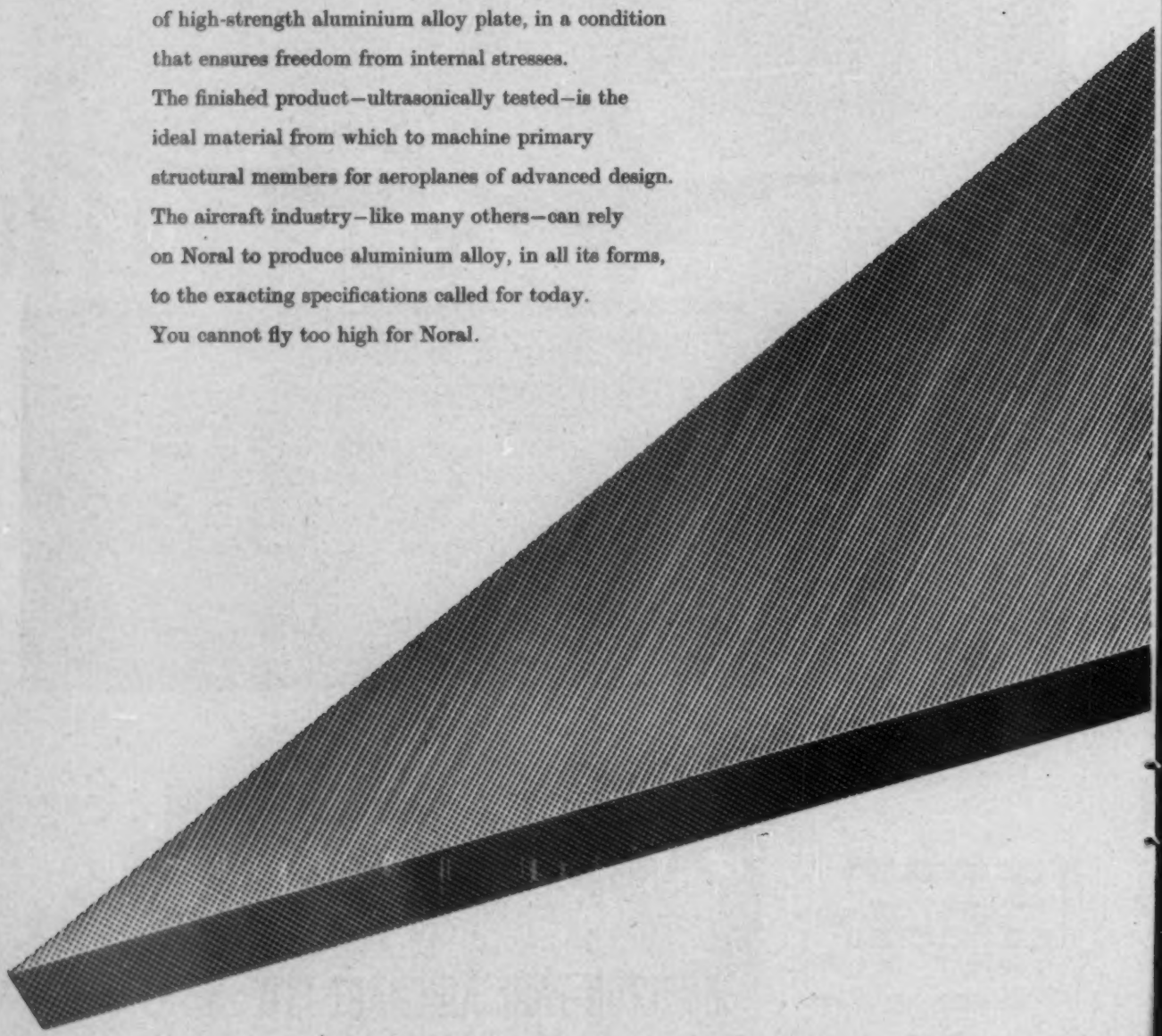

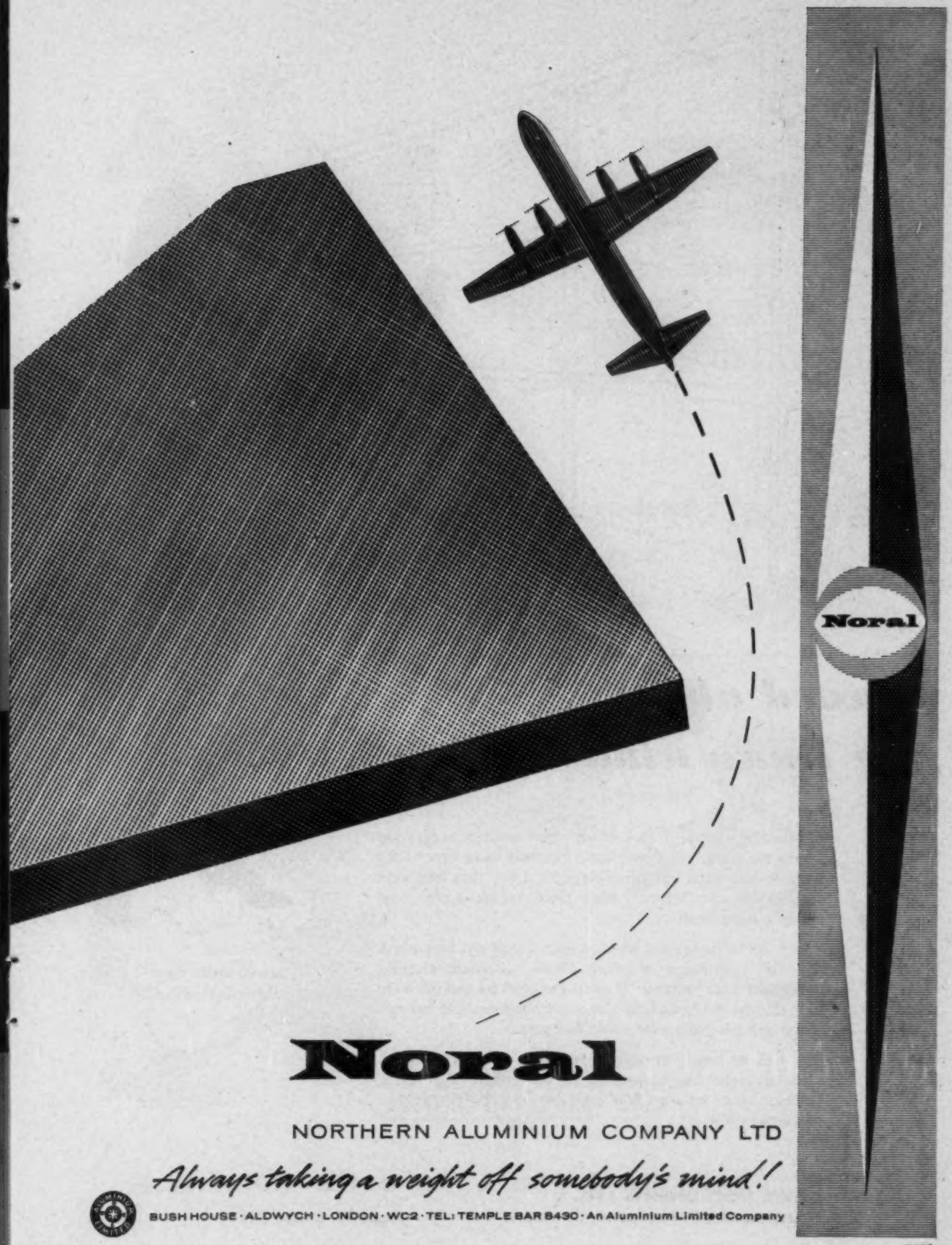

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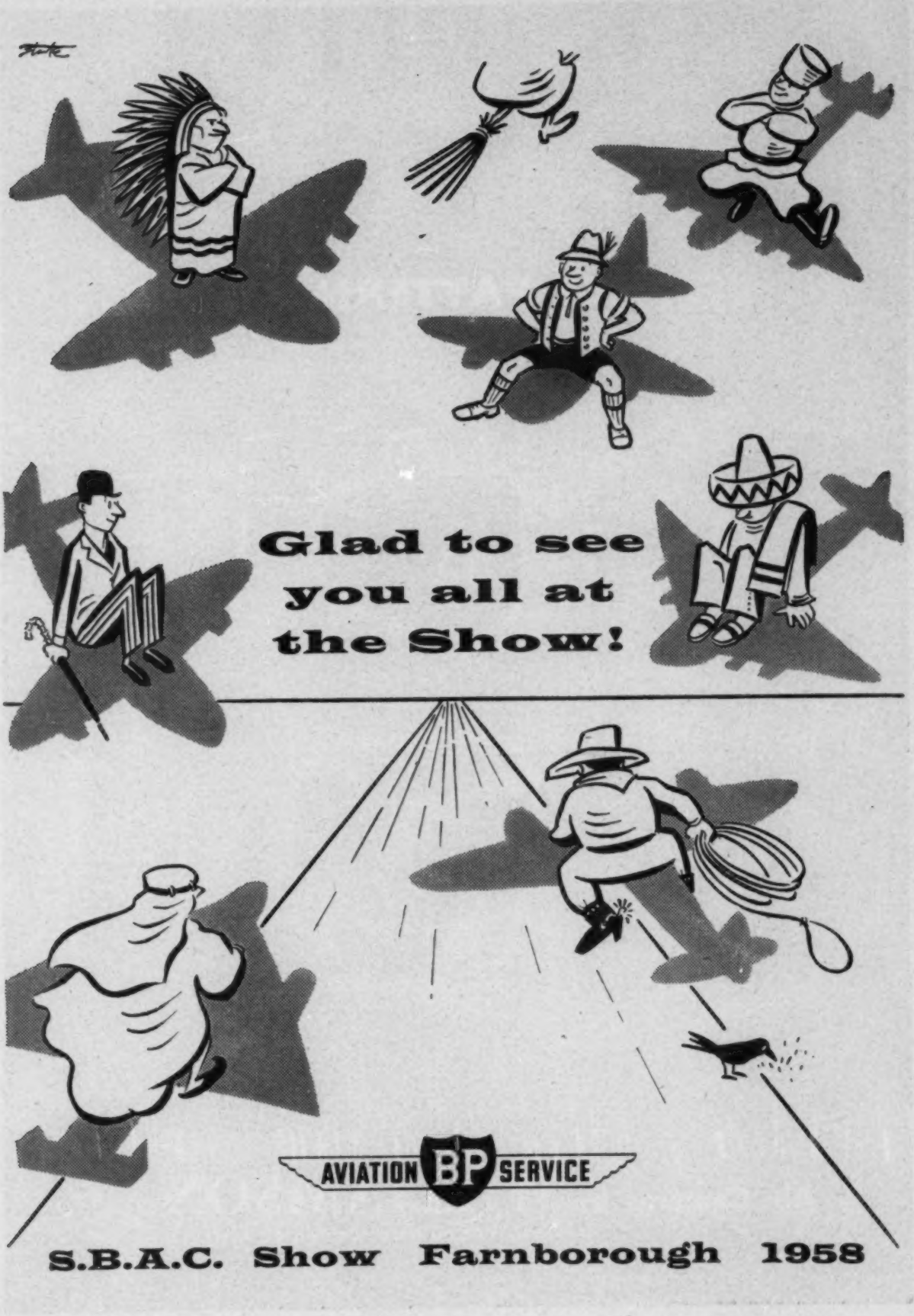
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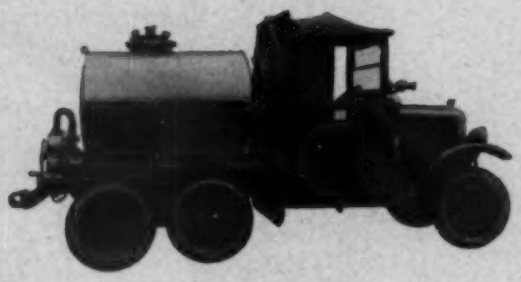

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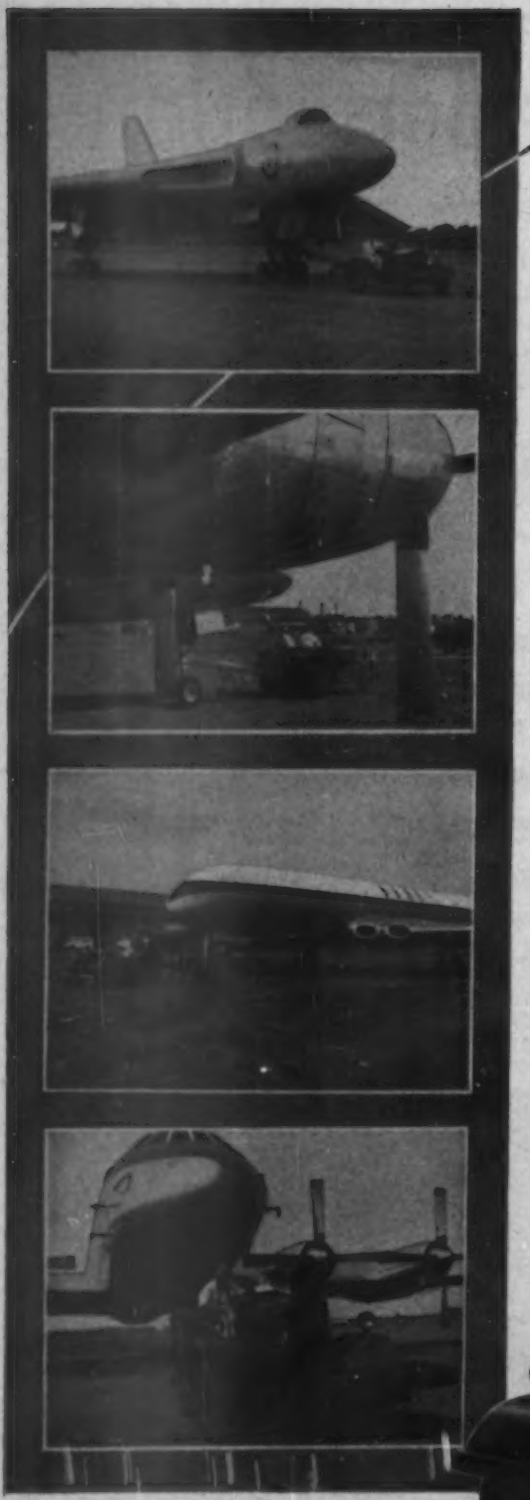

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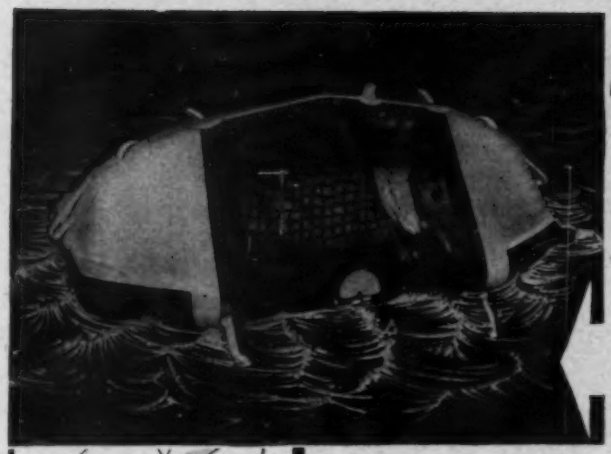

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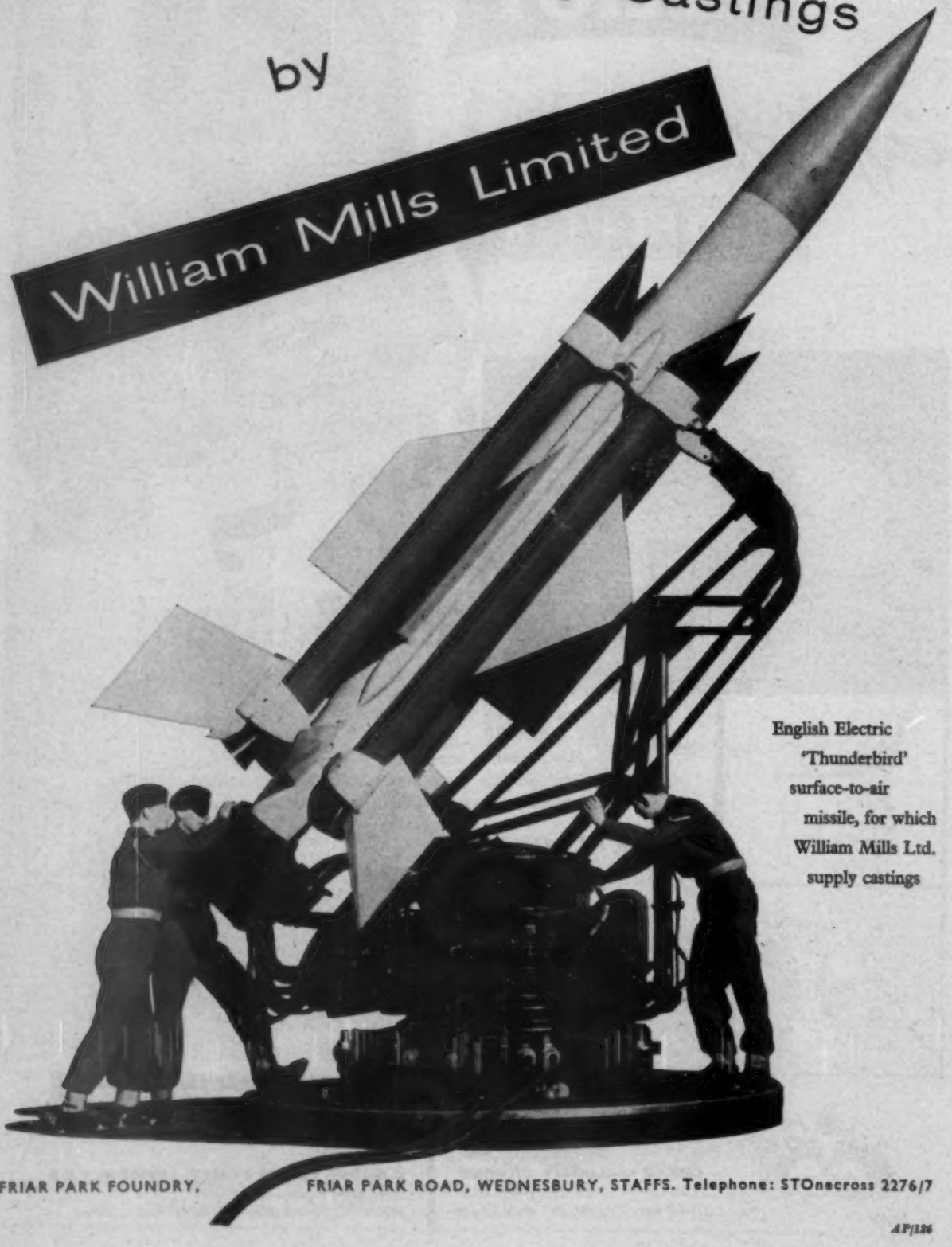

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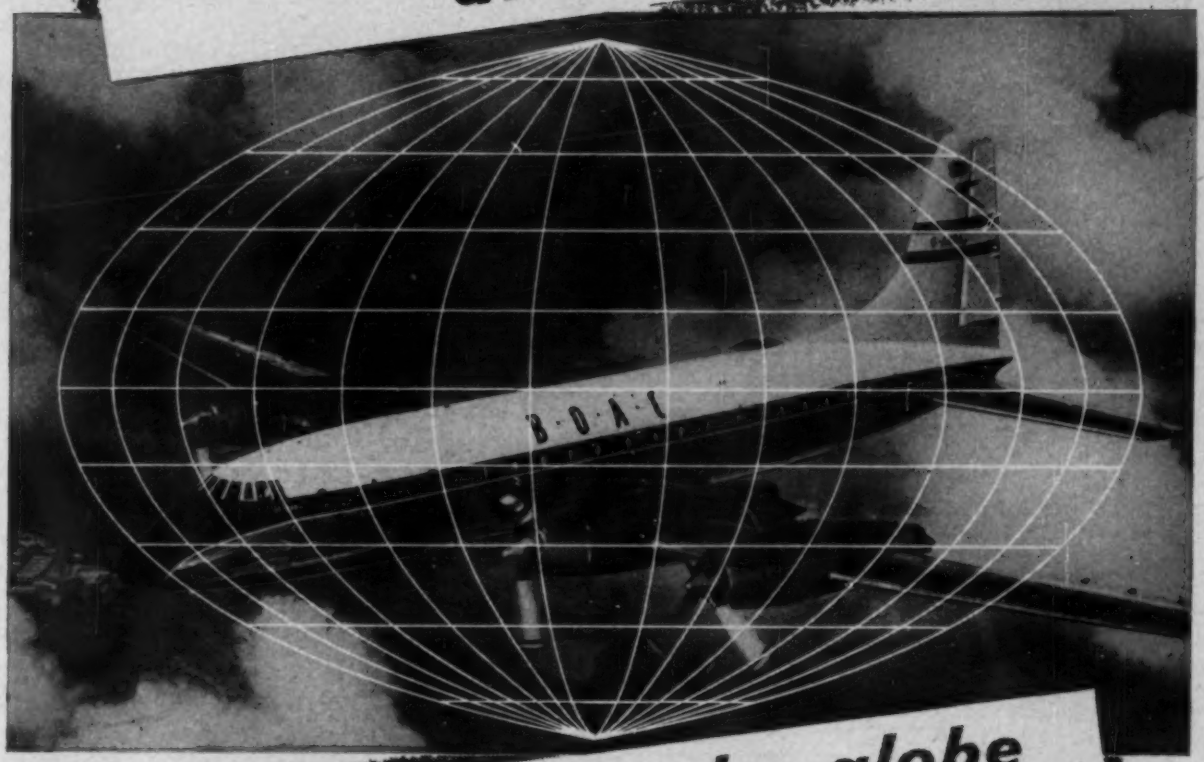

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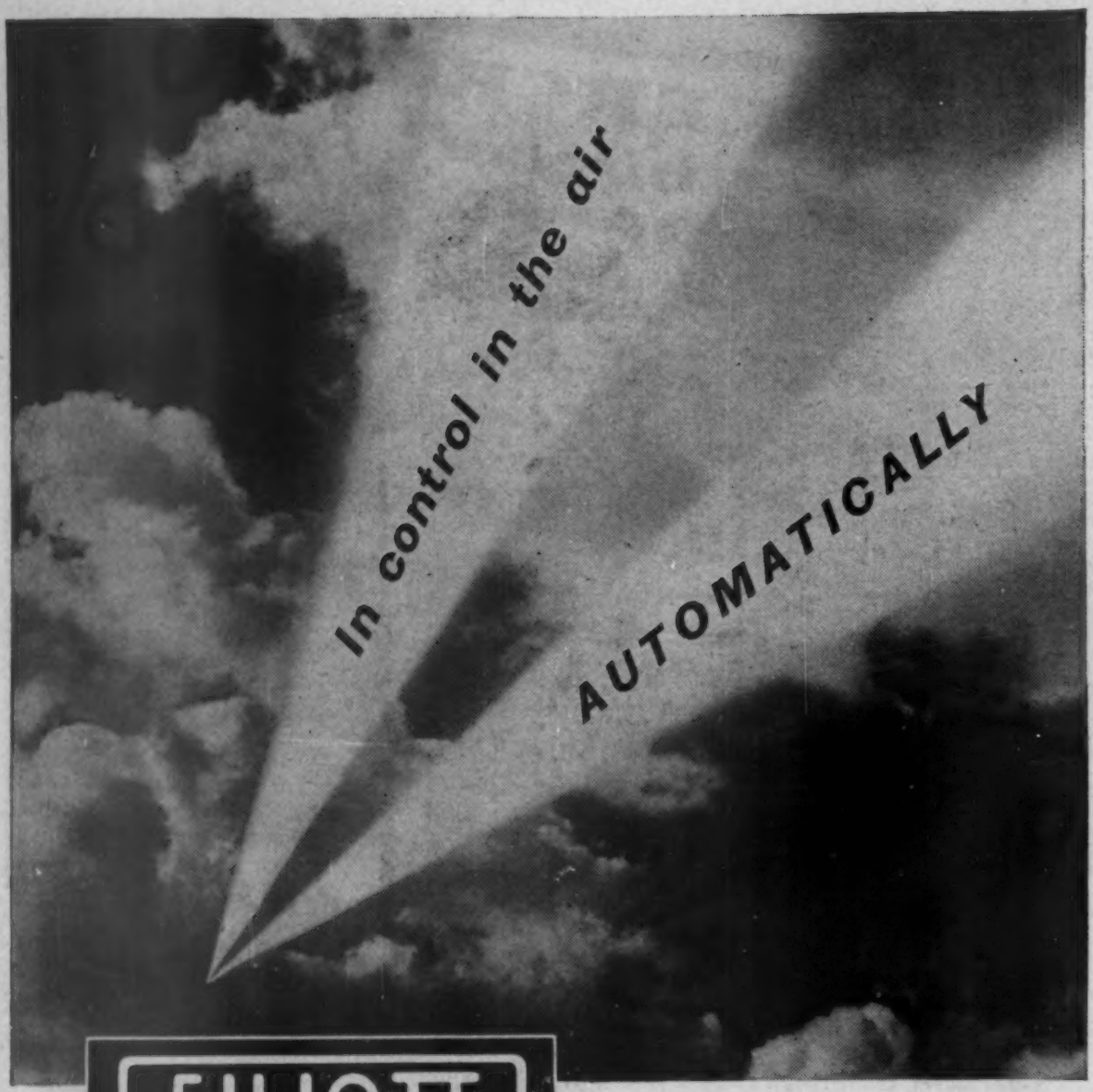

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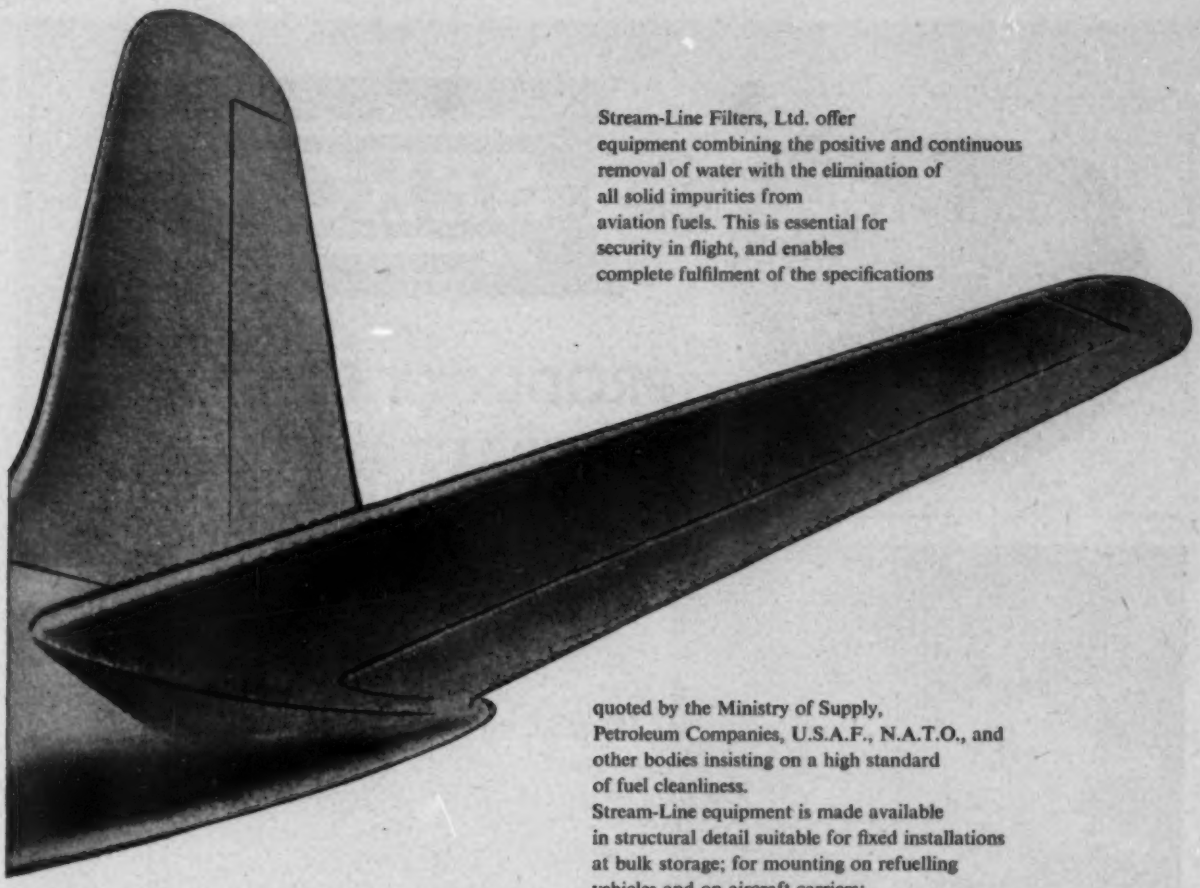

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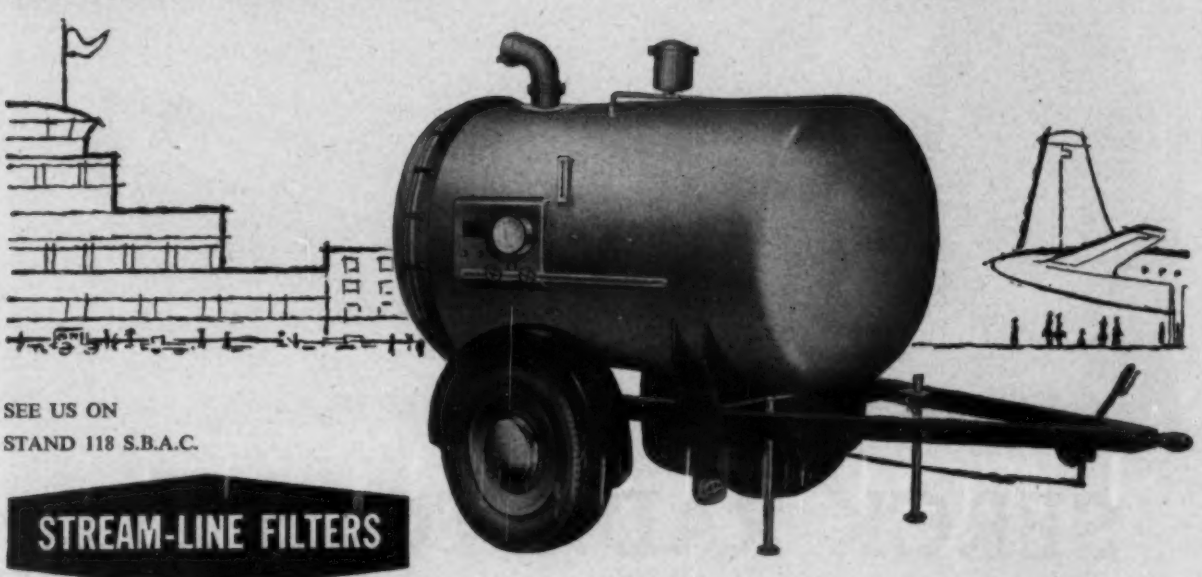

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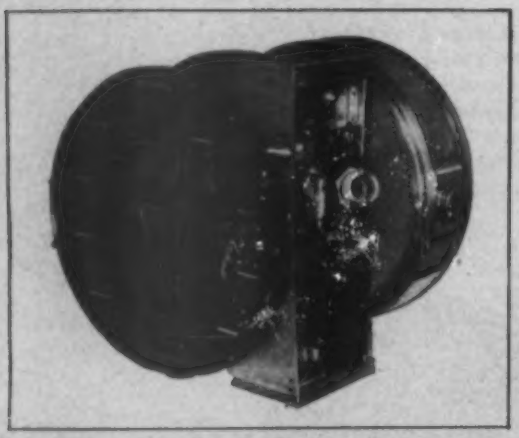

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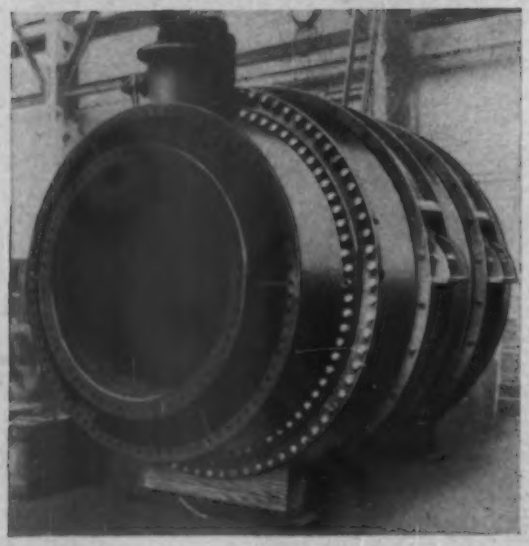

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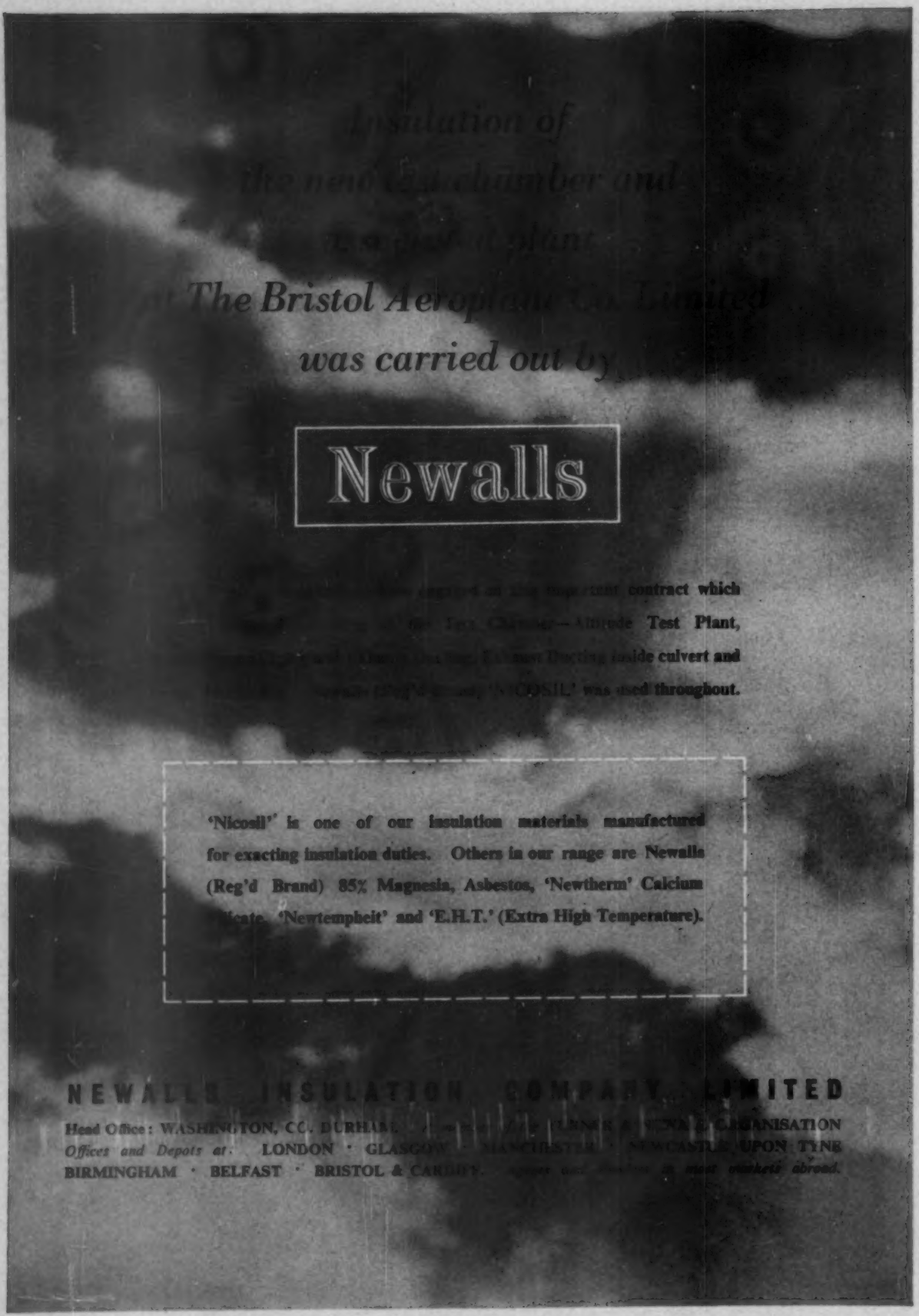
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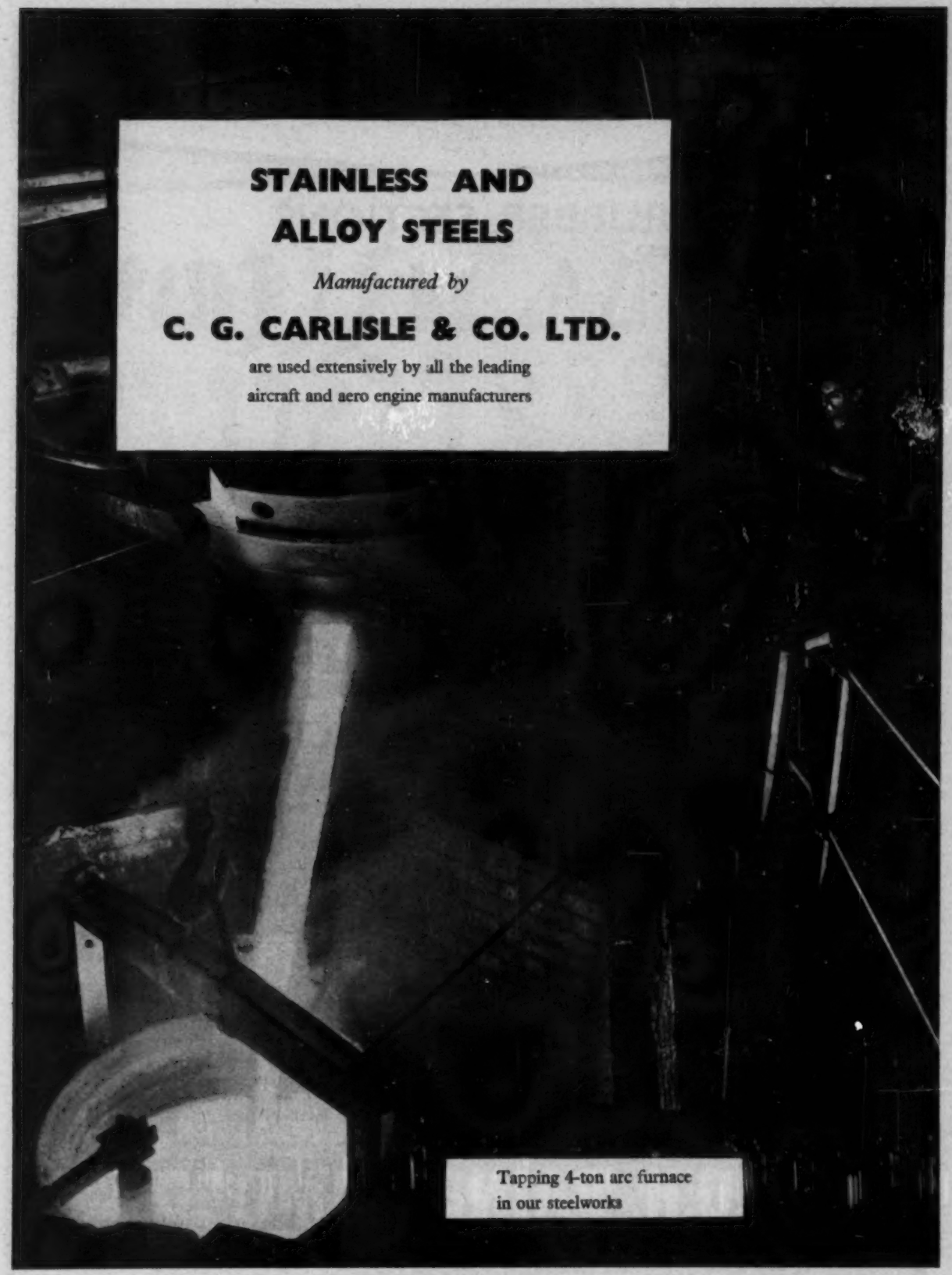

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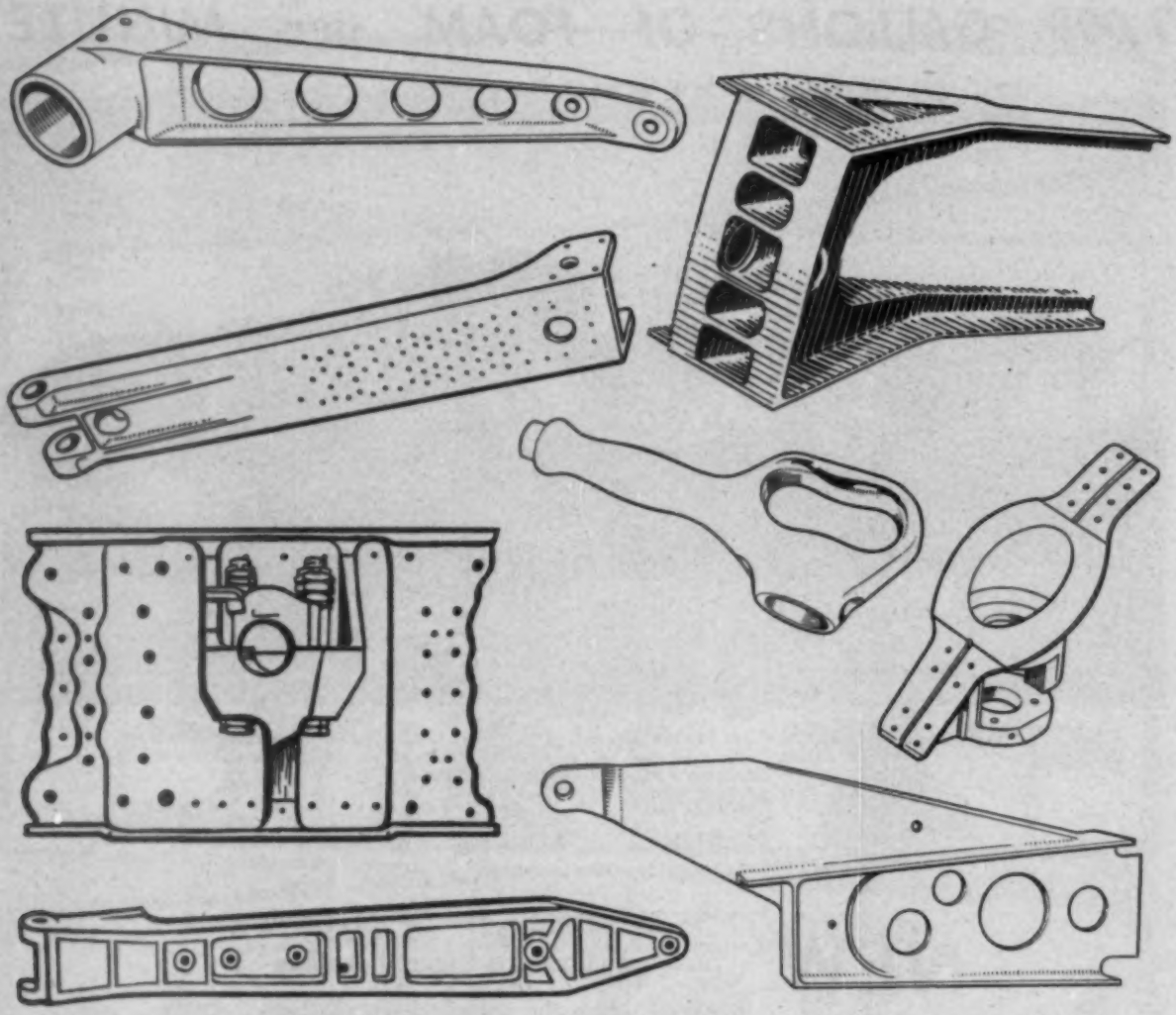

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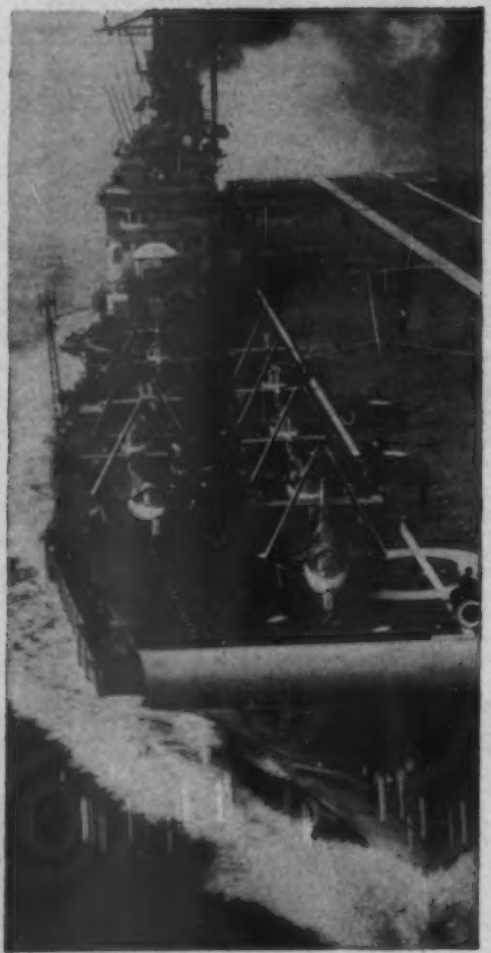

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For One and All

NEXT Monday we shall flip the calendar over to September, the month of which we ask (and occasionally get) clear skies and serene air. Good Farnborough weather, as everyone calls it; for Farnborough Week to us in Britain has become—indeed, has quite deliberately been made—an occasion of interest and importance to the whole nation and not to a mere section of industry. In essence, of course, it remains a trade show, and as perfect an example of one as will be found. But come next Friday the multi-million-pound showroom of that businesslike body the Society of British Aircraft Constructors will be transformed into a wonderful holiday-ground, to delight the people of Britain.

The Air Force and the Navy will join in with their best, and though there will be the usual mutterings about prestige, taxpayers' money and unedifying matters of that sort, everyone will really be out to have a jolly good time. No longer is there wailing in the land for the glories of Hendon in the great days of old. We have our Farnborough and we are happy with it. The rest of the world is welcome to its own brands of manifestations, parades and expositions.

As we have said, Farnborough remains essentially a trade affair, and it is to the open-mindedness and open-handedness of the participating members of the S.B.A.C. that the thanks of the British public are firstly due. And it is always pleasing to us of *Flight* to remind participants and guests that it is the Ministry of Supply which once a year hands over this treasured old cradle of British flying—and with maternal instinct declines to have it rocked by supersonic bangs.

The 19th Flying Display and Exhibition of the Society of British Aircraft Constructors promises good business—and the best of British flying for one and all.

IN THIS ISSUE

From all Quarters 292
Curtain Raisers 293
Destination Farnborough ... 295
Straight and Level 297
Civil Aviation 298
Service Aviation 301
Correspondence 302
Industry in Transition 321
British Aircraft 1958:—
Armstrong Whitworth 303
Auster 304
Avro 305
Blackburn 306
Bristol 308
de Havilland 310
English Electric 313
Fairey 314
Folland 316
Gloster 317
Handley Page 318
Hawker 320
Hunting 326
Jackaroo Aircraft 327
F. G. Miles 327
M.L. Aviation 328
Edgar Percival 328
Saunders-Roe 329
Scottish Aviation 329
Short Brothers and Harland ... 330
Vickers-Armstrongs 331
Westland 333
Sailplanes 335
British Aero Engines 1958:—
Alvis 336
Armstrong Siddeley 337
Blackburn 336
Bristol 338
Bristol-Siddeley 337
de Havilland 339
Napier 340
Rolls-Royce 341
British Missiles 1958:—
Introduction 343
Armstrong Whitworth 345
Avro 345
Bristol 345
de Havilland 345
English Electric 346
Fairey 346
Short Brothers and Harland ... 346
Vickers-Armstrongs 346
Accessory Manufacturers' Year 347
Ancillary Industry 1958 355
Tabulated Data:—
British Military Aircraft 381
British Civil Aircraft 382
British Helicopters 382

CLIPPED COMET: First flown at Hatfield on August 21 was the Comet 3 prototype with its wing shortened by 7ft to 4B standard. Known as the 3B, it will be displayed at Farnborough in B.E.A. colours. Meanwhile certification tests of the Comet 4 are 95 per cent complete.

FROM ALL QUARTERS

R.A.F. at the Show

OVER 120 aircraft from Fighter, Bomber and Flying Training Commands are to participate each day during Farnborough Week as the R.A.F. contribution to this year's S.B.A.C. Show. Types involved will range from Jet Provosts, Hunters and Javelins to Canberras and Valiants and a Vulcan and Victor. Details are given in Service Aviation news, p. 301. (The Royal Navy's plans for Farnborough—formation aerobatics by Sea Hawks and Scimitars—were described, and rehearsals illustrated, in *Flight* for August 15, pp. 219 and 243.)

Stuart Davies Rejoins Avro

IT was announced this week that Mr. Stuart D. Davies is rejoining the Hawker Siddeley Group to take charge of engineering work on a new project, details of which the Group "cannot yet reveal." Sir Roy Dobson, managing director, stated that the move had been made possible by agreement with Sir George Dowty, chairman of the Dowty Group.

Mr. Davies was, until June 1955, chief designer to A. V. Roe, Manchester, and was responsible for the design and development of the Vulcan. In September 1955 he went to Dowty as managing director of Dowty Fuel Systems, Ltd. He originally joined Avro in January 1938 as assistant designer to the late Roy Chadwick. He was appointed experimental shop manager in April 1940 and chief designer in 1946. He was responsible for the design and development of the Shackleton, and also developed the 707 series.

BULLSEYE: About to hit a suspended target at Woomera is a cruciform - winged Malkara anti - tank missile. The United Kingdom Ministry of Supply has ordered 150 of these Australian wire - controlled weapons.

Czech Aircraft Agreement

AN agreement has been concluded between Omnipol, the Czechoslovakian Government aircraft export agency, and the Aircraft and General Finance Corporation, Ltd., following the recent visit to Prague of the Corporation's managing director, G/C. Edward Mole. Under it, he has been granted sole distribution rights for the Super Aero within the United Kingdom, and market protection throughout British colonies and protectorates to enable him to set up a chain of sub-agencies.

G/C. Mole states that a number of interesting civil aircraft and aero engines are available for sale from Czechoslovakia and can be imported against sterling purchase under the terms of the U.K./Czech trade agreement. These are the Super Aero, L.40 Meta-Sokol, L.60 Brigadyr, Zlin Trener and Heli-Baby; and the 65 h.p. Walter Mikron III, 105 h.p. Walter Minor 4-III, 140 h.p. Walter M.332, 160 h.p. Walter 6-III and 220 h.p. Praga Doris B.

The General Finance Corporation's address is 3 Red Lion Place, Green Street, London, W.1.

Extra-Mural Student

ALTHOUGH F. G. Miles, Ltd., are not participating in the flying display at Farnborough this year—the decision not to do so having been, however, "a very hard one to take"—they will have a Student at Blackbushe for demonstration purposes. It will be flown by Duncan McIntosh (whose handling of it was one of the delights of last year's show) on the trade days—Monday to Thursday—and the company will make "appointments to view" through their stand at Farnborough or their offices at Shoreham. They explain that they did not consider the three minutes' flying allotted to them sufficient to show off the Student's capabilities.

IN BRIEF

Malcolm Lockheed, one of the founders of the Lockheed Aircraft Corporation, died in California recently at the age of 70.

* * *

The Swiss Government is to buy between 75 and 100 Saab-J35 Drakens, if the type proves suitable during tests. First deliveries of 100 Hawker Hunters for the Swiss Air Force are to be made next month.

* * *

Two Sabres and an RF-84F Thunderstreak of the Royal Norwegian Air Force left Norway for Britain on August 21 to have Martin-Baker ejector seats fitted. It is intended to make these standard equipment in all Norwegian Air Force fighter aircraft.

* * *

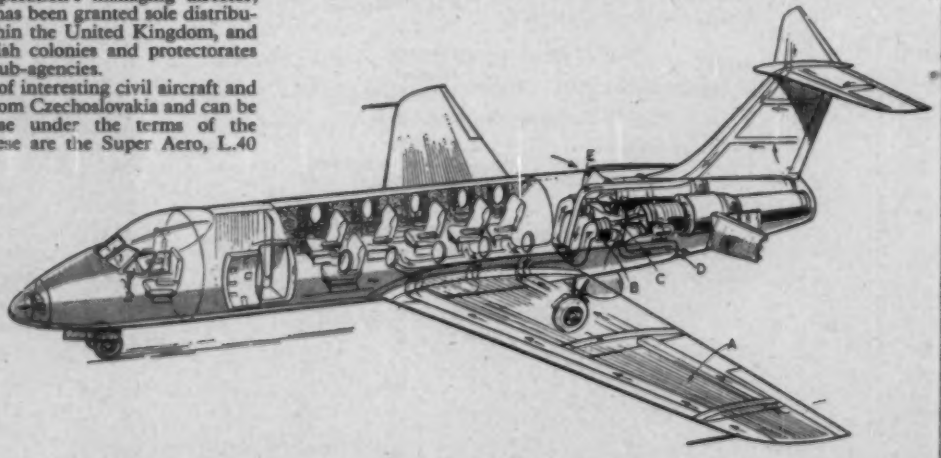
Some 60,000 people attended the "open day" held by the U.S.A.F. 20th Tactical Fighter Wing at Wethersfield, Essex, last Saturday. There was a large static show of aircraft and the flying demonstrations (though marred by rain) included 12 F-100Ds, four F-100Fs, three F-100s flight-refuelling from a KB-50 tanker, and four R.A.F. Meteor N.F.14s, four Javelins and a Chipmunk and Jet Provost.

* * *

The agreement between the Fairey Aviation Co., and the Kaman Aircraft Corp., for the manufacture and sale of the Rotodyne in the U.S. (forecast in *Flight* last week) was officially announced on August 19. On his return from the U.S. last Monday the company's technical director, Mr. R. L. Lickley, said that the agreement was not a restricted licence; it would not affect production either here or in other parts of the world, should further licences be issued.

* * *

The directors of Alvis, Ltd., have "with the greatest regret" accepted the resignation of Mr. T. C. Wallace, who has been sales manager of the company's aero sales division for the past 11½ years. Since joining Alvis early in 1946 Tom Wallace has been in charge of sales policy of the aero-engine side of its work and during that time "has visited most of the countries in the world and seen the Leonides establish itself in 24 of them." He has left the aircraft industry and is settling in the Orkneys.



This "Flight" drawing outlines the chief features of the H.P. 113 project, referred to opposite; key letters are: A, spanwise machined slits; B, four-stage suction compressors; C, shaft drive from Bristol Orpheus; D, suction air discharge; E, main engine intake each side.

Curtain Raisers

NEW PRODUCTS OF THE BRITISH INDUSTRY

NEXT week the Society of British Aircraft Constructors will stage their Nineteenth Annual Flying Display and Exhibition at the Royal Aircraft Establishment, Farnborough, Hants. Full details of admission for the general public, and notes on routes to the airfield, will be found on pages 295-296. On this and the following page is the latest news of products and projects which are expected to be available for inspection at Farnborough.

Avro Vulcan B.2 As noted on page 305, this improved Vulcan has a larger and thinner wing which permits the full power (presumably 68,000 lb thrust) of four Bristol Olympus 200-series turbojets to be utilized. At the time of writing, the first production Vulcan 2 has been completed at the Avro airfield at Woodford, Cheshire, and its first flight is imminent.

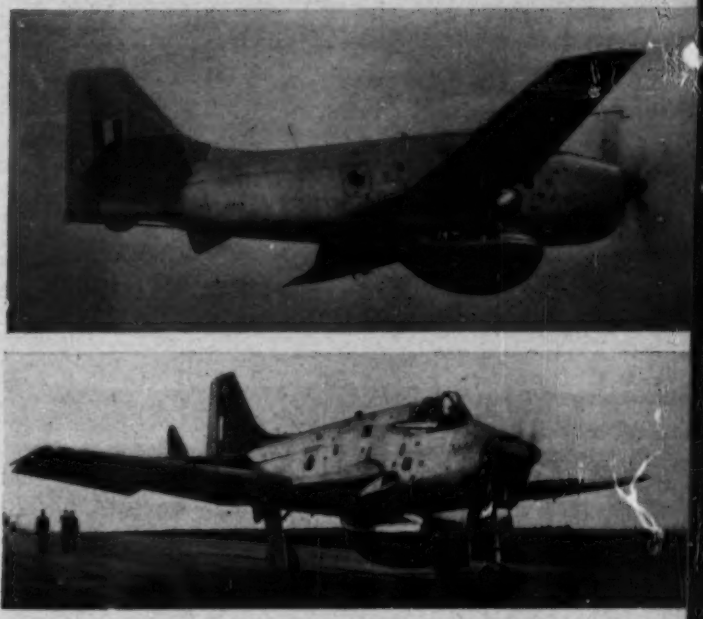
As we go to press, A. V. Roe confirm the report that company pilots intend to demonstrate a toss-bombing manœuvre at low altitude with a Vulcan B.1. Naturally this could not be attempted unless weather and other factors were suitable.

Fairey Gannet AEW.3 In almost every respect this flying radar station is entirely new, resembling the anti-submarine and trainer Gannets in essentials only. Designed to replace the Douglas Skyraider AEW.1 as the standard early-warner of the Royal Navy, the new Gannet carries a search radar beneath the forward fuselage. From 25,000ft the horizon is 200 miles distant (and, by simple geometry, it can be shown that an enemy aircraft also at 25,000ft could be picked up at a distance of 400 miles). Presumably the Gannet will be able to televise information back to its own fleet and it will also conduct radar operations against surface vessels and submarines, and act as a fighter/direction post.

Powerplant of the AEW.3 is doubtless the most powerful type of Armstrong Siddeley Double Mamba. The pilot sits high up above the engine, and the two radar operators are housed in the rear compartment, which is provided with hatches on either side incorporating bulged observation windows. The jet pipes are taken outside the fuselage ahead of the leading edge and exhaust beneath the wing (in other Gannets the pipes run inside the fuselage and issue above the trailing edge). The tail unit is completely new and provides effective control at all airspeeds, notwithstanding the presence of the large radome. The latter also necessitates increased ground clearance, provided by a stalkier undercarriage. The first AEW.3 (serial number XJ 440) was flown by the company's chief fixed-wing test pilot, Mr. Peter Twiss, on August 20. He flew from Northolt to the flight test establishment at White Waltham, and was airborne for 1 hr 16 min. He described the behaviour of the early-warner as excellent.

Handley Page H.P. 113 For many years Handley Page, Ltd., have been conducting a programme of research into the practicability of producing aeroplanes in which a significant proportion of the overall wetted area is in laminar flow. By this means it is theoretically possible to make aircraft much more efficient than any yet built, since the expenditure of energy in obtaining the laminar flow is very much less than the power saved by the consequent reduction in drag. Early studies have involved the use of a Vampire with special "gloves" on the wings. With this machine actual flight testing confirmed the advantages of the H.P. system, in which air is sucked out of the wing boundary layer through narrow spanwise slots.

The company now wish to demonstrate the full potential of such a system by building an aircraft designed to incorporate laminarization from the outset. Dr. G. V. Lachmann, H.P. director of research, has frequently stressed that such a system cannot be incorporated as an afterthought. The H.P. 113 has therefore emerged as a vehicle which, while eminently suitable for the complete exploration of laminar-flow in an aircraft designed with such a purpose in mind, should also prove to be a marketable proposition in its own right. It is, in fact, somewhat similar in concept to the U.S.A.F. utility UCX specification (transport and crew-trainer), but is rather smaller and has much greater range.

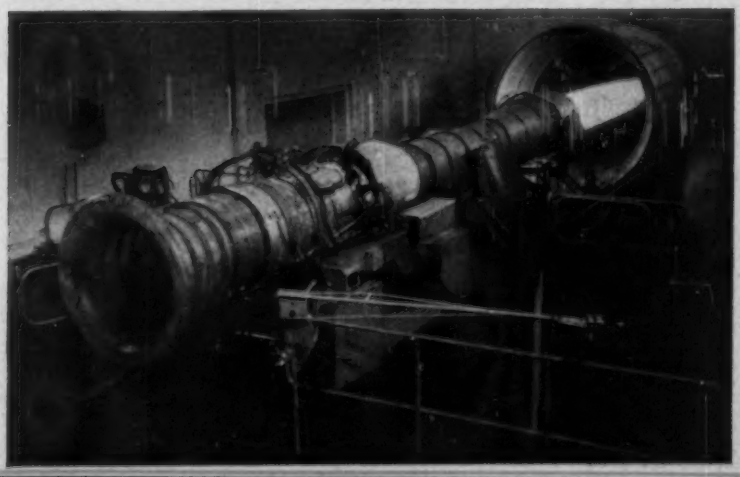


Pictured here on the occasion of its first flight, the Fairey Gannet AEW.3 is Britain's first early-warning aircraft. It differs greatly from the anti-submarine Gannets, as outlined on this page.

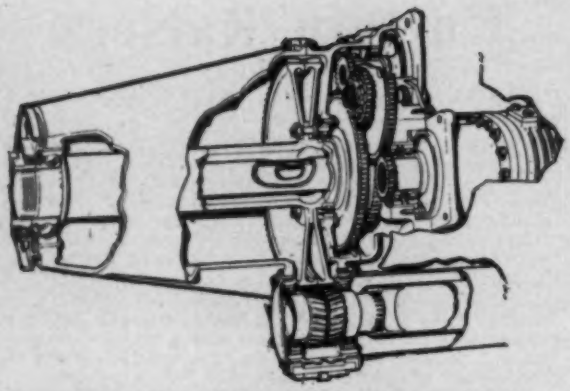
Basic characteristics are seen in the drawing opposite. Each of the Bristol Orpheus powerplants has an extension shaft driving a high-capacity four-stage axial suction compressor, which extracts air through the skin of the wings and tail and expels it through a pair of aft-facing nozzles in the rear fuselage. Over the greater part of the sucked area the skin contains carefully machined slits, but porous steel is used over the leading edges and wing access doors. An automatic blowing system is provided to increase the effectiveness of the ailerons and rudder at low airspeeds.

Basic data for the H.P. 113: span, 71ft 3in; length, 71ft 6in; height, 17ft; wing area, 775 sq ft; quarter-chord sweep, 35 deg; fuselage length, 65ft 6in; fuselage diameter, 7ft 3in; passenger cabin volume, 900 cu ft; basic operating weight, 20,450 lb; fuel capacity, 2,290 Imp. gal; max. payload, 2,520 lb; gross weight, 36,500 lb; wing loading, 47.1 lb/sq ft; take-off to 50ft (s.l., I.S.A. + 15 deg C), 3,260ft; time to 30,000ft, 14 min; rate of climb at 36,500 lb at 30,000ft, 1,700ft/min; cruising speed, 528 m.p.h.; stage-length with 1,000 lb payload, 4,330 st. miles; touchdown at s.l. at 25,000 lb, 106 m.p.h.; landing from 50ft without reverse thrust, 2,480ft. Maximum range is increased by laminarization from 3,870 to over 6,300 st. miles.

Westland Westminster Fully described in our August 15 issue, the crane/transporter Westminster (two Napier Eland) will be seen flying at Farnborough. Westland have just issued the following final figures for it, with corresponding values for the monocoque-fuselage passenger transport in brackets: basic weight, 21,600 lb (21,245); crew, 400 lb (400); fuel and payload, 14,000 lb (11,335); gross weight, 36,000 lb (33,000); sea-level cruise, 115 m.p.h. (150); max. range, 207 st. miles (450); rate of climb at 86 m.p.h., 1,900ft/min (2,350); single-engine climb,



New powerplants by Bristol-Siddeley are the Armstrong Siddeley PR.23 rocket, described overleaf, and (left) the reheat Bristol Olympus 200. The latter, which in 201 form has a dry rating of 17,000 lb, is seen with its Solar afterburner on test at 24,000 lb.



The upper three illustrations on this page show, reading anti-clockwise: the final reduction gear and propeller drive of the turboprop D.H. Gnome; the first production Short/English Electric Canberra PR.9, which has now been flying at Belfast for a month; and a Short/English Electric Canberra U.10 pilotless drone, converted from a B.2.

CURTAIN RAISERS . .

300ft/min (700); vertical climb, 130ft/min (920); hovering ceiling for 10ft wheel clearance, 9,000ft (14,000); sea-level cruise consumption, 290 Imp. gal/hr (307).

Bristol/Ferranti Bloodhound. Now in full production for the R.A.F., and already in service with Fighter Command, the Bloodhound is at present the standard surface-to-air weapon for home defence. Bristol are now permitted to state that Bloodhound has a longer range than any other missile with semi-active homing radar in the Western world. As such radar is fitted to the Bendix/McDonnell Talos of the U.S. Navy, it can be assumed that the range of Bloodhound is comfortably in excess of 68 miles (Bomarc is fully active in its terminal phase).

An accompanying photograph shows a Bloodhound on its launcher, which is made by M.L. Aviation. The weapon is brought to the site on a combined transporter/loader, which supports the body of the missile in a low position for cross-country stability and in a high position for feeding it on to the launcher. The missile locates with the launcher rear support and is held in position by two arms which are positioned under the forward boost-motor fittings. The securing straps are then released and the launcher raised slightly so that the trolley can be removed. Ground-running supplies are connected at the centralized quick-break socket and the launcher beam is then raised hydraulically to its maximum height preparatory to firing.

Pye Guided Weapon. Produced as a company venture, the Pye guided weapon is a battlefield-type surface-to-surface (or, possibly, air-to-surface) weapon controlled by command signals transmitted through trailing wires. Propulsion is effected by a two-stage solid-propellant motor—made by Bristol to a Pye design—the first charge giving high thrust for acceleration to the subsonic cruising speed and the sustainer feeding a row of nozzles around the periphery of the weapon immediately behind the wing cruciform. The control system apparently masks one or more of these nozzles to steer the missile; there are no aerodynamic controls. Overall length is about five feet, and the weapon can be carried by a man for short distances.

The photograph indicates the tracking flares, wire-bobbin fairings and hollow-charge warhead with its protruding impact fuse. The complete weapon system is remarkably rugged, light, simple and cheap (each round has an estimated bulk-production price of £1,000), and includes a tubular launcher, a control box, hand-held thumb-button joystick unit and a pair of prismatic binoculars, the magnification of which can be increased as the weapon flies away. Many trial firings have taken place, and Pye can, subject to government permission, sell the complete system abroad when it is developed. It is presumably in competition for British Army orders with the Vickers 891, the Malkara and a system which, owing to its official sponsorship, is still security-restricted.

A.S.M. PR.23. Armstrong Siddeley Motors have been granted security clearance to display a very attractive 500 lb-thrust rocket motor (picture, page 293). Designated PR.23, the new engine is a completely self-contained variable-thrust unit with pump-fed liquid propellants. Thrust is variable up to 500 lb and the total weight is 30-32 lb. Applications include the vernier trimming of long-range ballistic missiles, augmenting aerodynamic controls of aircraft at extreme altitude, providing desired pitch moments on heavily loaded aircraft on take-off, or giving additional thrust in emergencies.

D.H. Gnome. A drawing above shows the final propeller drive of the turboprop version of this neat 1,000 h.p. engine. This fixed-wing variant weighs 525 lb, half of which is gearbox and drives. Testing will start next summer.

Also to be at Farnborough: the new Pye guided weapon (below) with launcher, control units and operator; and (left) a Bristol Bloodhound on its launcher, with transporter/loading trolley in background.

DESTINATION FARNBOROUGH

Ways and Means for the Show Visitor

IT is perhaps a pity that Karl Baedeker lived too soon for Farnborough. That inquisitive high-priest of the guide-book would probably have had many informative things to say about this annual major European attraction. Undoubtedly he would have advised tourists to "take in" the display, along with Stratford-on-Avon, Winchester and Salisbury. His guide would have dwelt with buoyant curiosity on the local hotels (having previously sampled their menus incognito), times of trains and buses, road approaches, hours and prices of admission and a *minutiæ* of other helpful detail. Alas for Baedeker; this pleasure was denied him. But since he set so thorough an example it can at least be followed here in providing a visitors' guide to next week's Society of British Aircraft Constructors' Flying Display and Exhibition.

Dates and Times

Farnborough begins officially next Monday (September 1) with a Press and technicians' preview day and Tuesday, Wednesday and Thursday are reserved for guests of the S.B.A.C. Friday is the public première and Saturday and Sunday are also both public days. On each day during the week the gates of the airfield open at 10 a.m. and close at 7 p.m.; and on the three public days the flying display starts at 3 p.m. (on the other days it begins at 2.30 p.m.).

Admission Prices

Charges for admission vary on the public days. On the Friday they are £1 for adults and 10s for children under 14; while parking fees are £1 for cars and motor coaches, 5s for motor cycles and 2s 6d for pedal cycles. (These parking fees are exclusive of admission charges, which must be paid for all occupants of vehicles). It is also to be noted—as Baedeker might put it—that advance bookings may be made for Friday, *and Friday only*, through Auto-Parks, Ltd., 1 Maclise Road, London, W.14, or the usual entertainment-ticket agencies. Otherwise, "pay at the gate" is the rule.

This must be done on the Saturday and Sunday, when admission charges are 5s for adults and 2s 6d for children under 14. The charge for private cars on these two days is 30s, which includes admission for up to six occupants. (If a car carries more than half-a-dozen passengers, those in excess must pay admission charges at the normal rate.) Parking fees for motor coaches, motor cycles and pedal cycles on the Saturday and Sunday are 10s, 2s 6d and 2s respectively.

Routes by Road

Having disposed of those sordid (but essential) financial details, it is pertinent now to consider how one gets to Farnborough. Travelling by road, the recommended routes can be seen on the accompanying map. From London, they are either via Guildford and the Hog's Back (A31) or by the A30 to Bagshot and then down the A325. From Oxford and the North, through Reading and then down the A327. From Basingstoke and the West, along the A287; and from the Portsmouth area and the South Coast, up the A31 or A325 or A287.

These routes will be signposted to Farnborough by the R.A.C., who with their companion organization the A.A. are this year as usual doing all they can to help road-users. Both will have road patrols in radio contact with a control centre on the airfield itself, where they also provide helpful facilities. Consequently no motorist or motor cyclist should get stranded; for if he wants help there should be a patrol-man not far away. But to all road-users going to Farnborough, whatever the speed of their vehicle, the motoring organizations offer this simple perennial advice: start early and follow the official routes.

Congestion is inevitable in the Farnborough area, especially at the week-end; but anyone who has been to an S.B.A.C. Show by road knows how well the traffic is handled by the police, who do a splendid job in ensuring that there is the minimum of delay in getting to the display and away from it. Two extra bits of advice may be given to all drivers: obey the rules; and exercise courtesy and restraint, especially under trying circumstances. In the long run, this will make things easier for everybody.

Road approaches to the airfield will be signposted by the R.A.C. To follow the approved routes (as described above) is essential.

Rail and Bus Facilities

For those not travelling to Farnborough by car, coach or motor cycle, British Railways and the Aldershot and District Traction Co. have arranged special facilities. Cheap tickets are issued by B.R. from London and from many other stations to Farnborough and Aldershot stations on the public days; and the Aldershot and District Traction Co. operates a service of buses from Aldershot and North Camp stations. There are combined rail-and-road tickets at attractive fares, an example being 9s for a Waterloo to Farnborough day return.

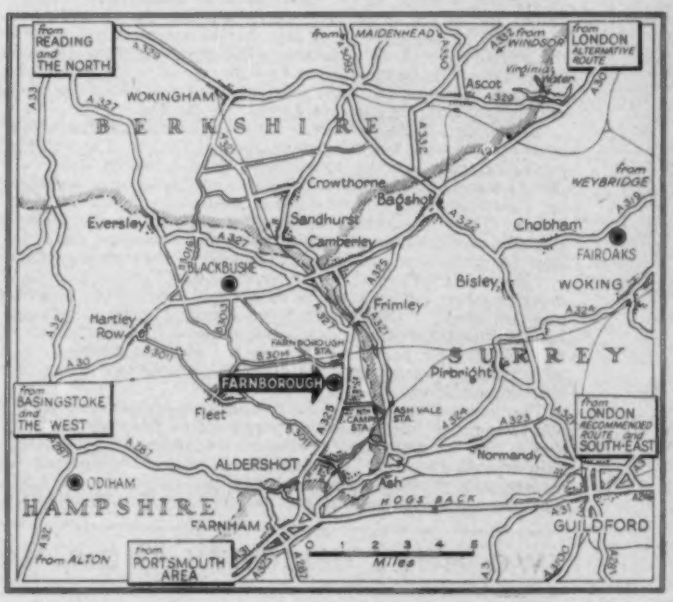
The Aldershot bus company also runs coach services from London (Victoria Coach Station) to Farnborough Town Hall, leaving from 8.50 a.m. and hourly at 50 minutes past the hour, the journey taking approximately one hour 35 min. The fares are 4s 9d single, 6s 9d for a day return and 8s for a period return. There is a setting-down point near the airfield. Seats may be pre-booked either at Victoria or through travel agencies.

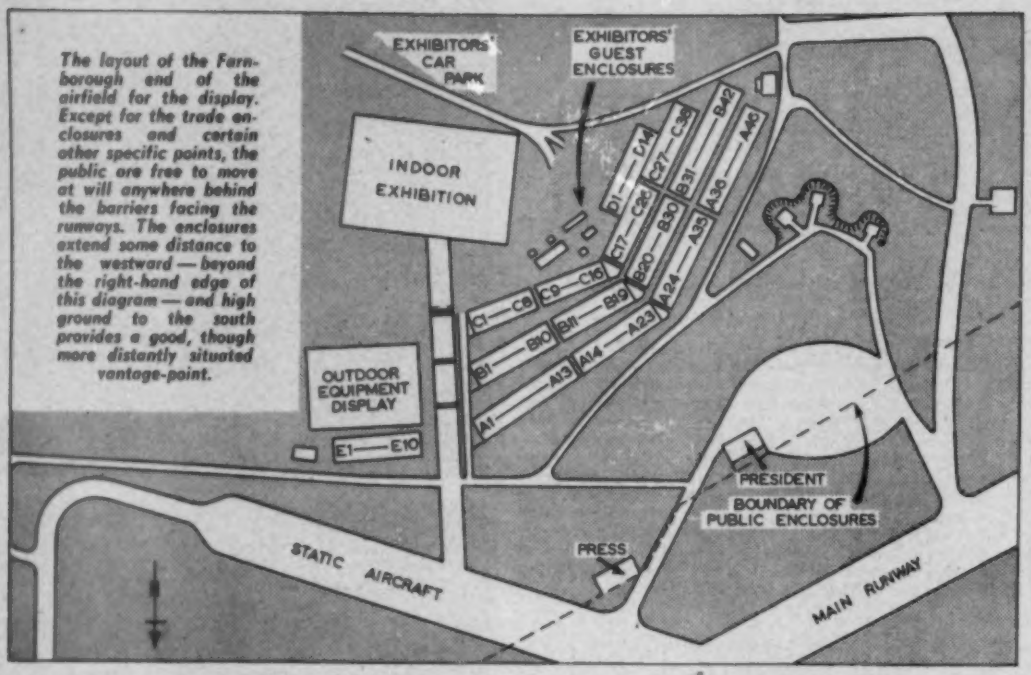
Within the Gates

Having got safely to Farnborough, whether by road or rail or even on foot (for those who live near enough to the airfield), the important thing is to make the most satisfying use of one's time while attending the Show.

It is feasible, if the weather be fine and dry, merely to sit out on the grass and watch the finest pilots in Britain—civilian and Service—put on a flying display which for sheer verve and variety is almost without parallel anywhere. But the great static exhibition, in which almost every manufacturer of aircraft and parts in this country shows off his latest wares, should not (as Herr Baedeker would say) be missed. It is as inspiring, in a quieter vein, as the spectacular flying display; for here is vast visible proof of all the skill and ingenuity of Britain's aircraft industry.

The Society of British Aircraft Constructors, which performs an annual miracle in organizing this great show, goes out of its





The layout of the Farnborough end of the airfield for the display. Except for the trade enclosures and certain other specific points, the public are free to move at will anywhere behind the barriers facing the runways. The enclosures extend some distance to the westward — beyond the right-hand edge of this diagram — and high ground to the south provides a good, though more distantly situated vantage-point.

DESTINATION FARNBOROUGH . . .

way to provide all possible amenities. Directions are clearly signposted; there are restaurants, snack bars, information offices, bookstalls, a Post Office, and (need we add?) the other conveniences the public requires on a day out. Litter bins are prominently placed, and everything should be done to keep Farnborough as tidy as it was before. (In past years the workers at the Royal Aircraft Establishment have had to wade back on the Monday through a sea of paper—a poor return for the hospitality which their employers, the Ministry of Supply, have offered to the public.)

* * *

In short, great entertainment and instruction are offered; and nothing—not even the weather (which it is to be hoped will smile)—can really mar the thrill of Farnborough week. For Herr Baedeker, had he ever had the pleasure of attending, the occasion would undoubtedly have been a European highspot and to be heartily recommended.

M.o.S. WORK ON VIEW

AS in former years, the Ministry of Supply are themselves taking part in the forthcoming S.B.A.C. Exhibition—which, as mentioned in the preceding guide, is held on their own property, at the R.A.E., Farnborough—and four of the principal exhibits on the M.o.S. stand have each been culled from a separate establishment. The R.A.E. contribution is a pilot-view simulator, which makes available a forwards perspective view which varies according to the movements imparted to the flying controls in a cockpit. The view is synthesized optically. A transparency is projected on to a screen, which is then viewed obliquely by a television camera placed at one side. The camera thus sees in perspective a scene which may consist of countryside (using a survey mosaic), a cloud layer or an airfield, the picture being completed by the addition of sky. Servos are provided to move the several parts of the apparatus. The ground picture is moved translationally or in rotation, and height can be varied by altering the focal length of the lens; movements of the aircraft in pitch and roll are simulated by rotating the TV camera.

When used in conjunction with an aircraft simulator the equipment gives a faithful reproduction of the visual scene. For exhibition purposes the servos have been arranged under the direct control of a small control column; bank and elevation angles are limited and the ground cover is restricted to about 20 miles square. These restrictions can be removed when greater space is available. Originally designed for visual-flight research, the simulator has been found to have applications in the training sphere.

The exhibit sponsored by the National Gas Turbine Establishment describes the static testing of ramjets. At the N.G.T.E. two cells are used for the simulated test flying of ramjets, each cell having a diameter of 12ft and being designed to accept air at up to 9 : 1 pressure ratio and 600 deg K. Ejectors driven by this air-supply provide suction to about 0.067 atmosphere to simulate altitude conditions.

The first cell is arranged for testing with a supersonic supply over a range of inlet pressures, temperatures and angles of incidence. The limiting capacity of the cell is a ramjet of approximately 24in overall diameter. The second cell provides connected rig testing, with all the air passing through the ramjet (i.e., no spill). The air supply is metered and passed through a floating box which permits measurement of thrust. The two cells together can provide all the testing required prior to free flight, and permit the gathering of additional data unobtainable by other means. Photographic recording and a digital computer are employed in the full-scale installation.

An important exhibit by the Royal Radar Establishment outlines the cooling of radar equipment in high-speed aircraft (or, presumably, missiles) by closed-circuit liquid systems. Numerous advantages are claimed for such a system in comparison with air cooling, and the only drawbacks seem to be confined to the risk of leakage and some loss of flexibility in the construction of experimental prototype systems. The R.R.E. are displaying various applications of liquid cooling, including a fabricated soldered-tube unit and some early experimental examples showing integral chassis dissipating heat in insulated and sealed containers.

Two integral-chassis materials currently being investigated are an electro-formed seamless nickel honeycomb, with walls of about 0.010in, and a recently available commercial aluminium ducted sheet. Either type of chassis is used in a pressure-tight container, heat transfer from the electronic components being primarily conductive and convective. The coolant is pumped from a reservoir to the electronic equipment, and back to the tank via a rejection heat exchanger.

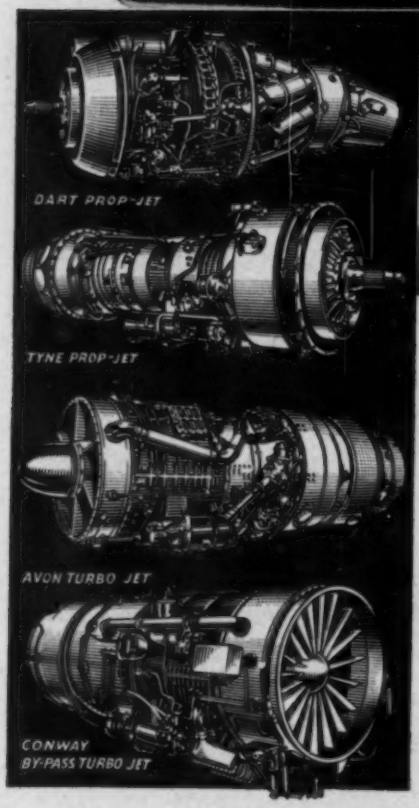
A fourth major exhibit, designed and produced by the Inspectorate of Electrical and Mechanical Equipment, M.o.S., is a three-dimensional continuous automatic measuring machine. It has been produced by converting an existing machine tool into a three-dimensional, tape-control machine fitted with Ferranti electronic control and the I.E.M.E. measuring system. The machine is controlled to follow the exterior contour of the component under examination. A perfect component produces no displacement of the ball-end of the measuring-head stylus, but deviation from the desired profile results in displacement of the recording trace by a proportional amount. Basic accuracy of the machine was improved by incorporating air bearings on the slides, special floating recirculating ball nuts and lead screws to the drives (manufactured by the Coventry Gauge and Tool Co.) with pre-loaded ball-bearings. The capacity of the machine is a component 32in × 21in × 7½in.

TWO MORE "FLIGHT" SHOW NUMBERS . . . *September 5: FARNBOROUGH REPORT*
September 12: FARNBOROUGH REVIEW

ROLLS-ROYCE

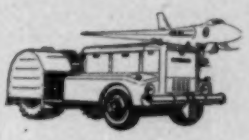
POWER

in the air . . . on the airfield



Rolls-Royce are unique in being the only aero engine manufacturers in the world making four different types of gas turbines for civil and military aircraft. Aviation is also being served by Rolls-Royce petrol engines in airfield ground equipment and by diesel engines which power civil engineering equipment in the construction and development of airfields. Nuclear and rocket power units are also being developed by Rolls-Royce engineers.

Airfield Crash Tender on a Thornycroft Chassis powered by a Rolls-Royce Petrol Engine.



Pethow "Power-Puller" Ground Power Unit powered by a Rolls-Royce Diesel Engine.

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S.B.A.C. EXHIBITION

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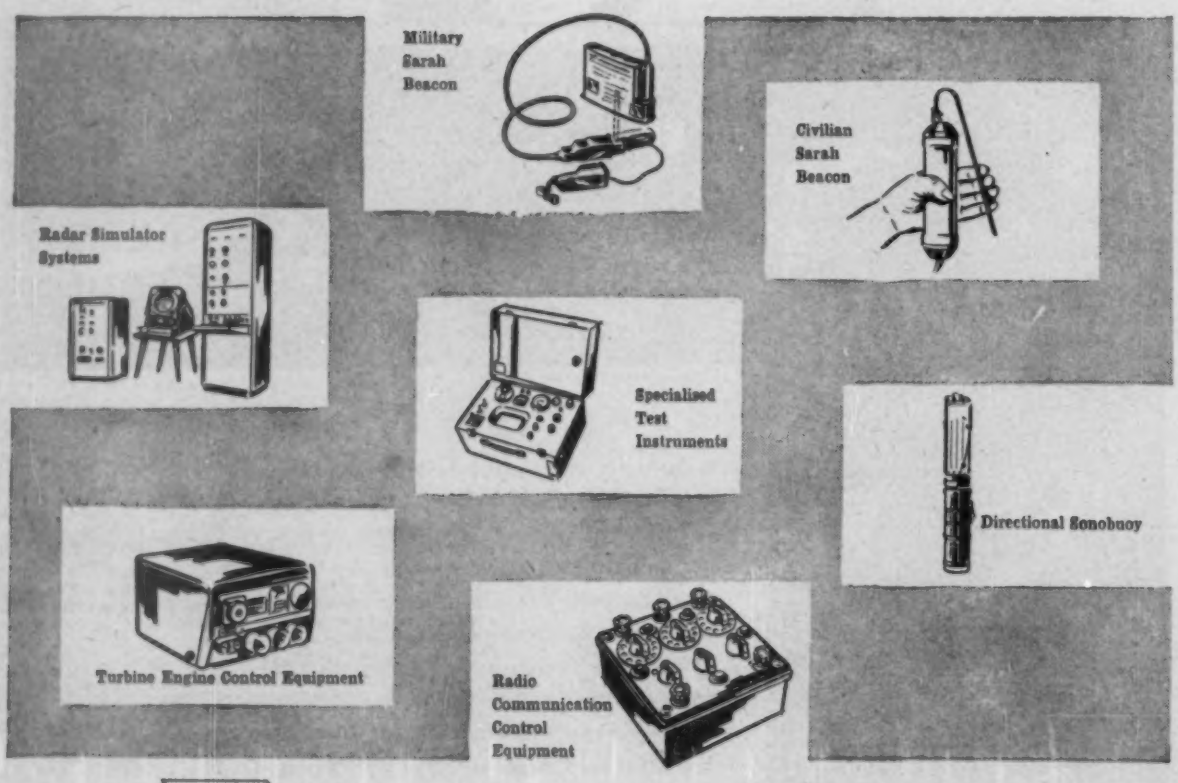

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Straight and Level

HOW resoundingly off the tongue rolls the after-dinner phrase British Air Power. It is an expression which is always good for a round of approving hear-hears, because there breathe few Britons who do not want to see their country as influential in the air today as she was on the sea yesterday.

But unfortunately the expression has become tainted with megalomania; and the nation has learnt that air power is best attained more by cool calculation than by emotional—and therefore wasteful—aspirations to greatness.

Britain, of course, *is* an air power. Her air force is equipped to deliver the thermonuclear deterrent. Her civil air fleets carry more traffic than any Western nation except America. Her aircraft industry is second in size and diversity in the West. So shame to all old fogeyisms about the need for Britain to become an air power. She *is* one.

● Recently we had a starry night—a rare thing in this cloudy island—and I enjoyed hearing the majestic passage of a 1649 (or perhaps it was a Seven Seas) at about ten thousand feet. Had the noise been a jet I would have immediately thought it was military; and, notwithstanding B.O.A.C.'s Comet 1 operations, it is still hard for me to reconcile the ideas of jet propulsion and fare-paying passengers. Even harder is it to believe that, inside 14 weeks, I can expect to have thunderous, water-methanol-smoke-belching, hundred-ton monsters doing second-segment climbs over my rose bushes.

● Convair's Astronautics division held open house recently, when the San Diego public were admitted to the vast new $40m plant out on Kearney Mesa. It seems that, every hour on the hour, somebody fired a miniature Atlas missile on a 250ft course into a charge of powder.

Now I personally feel there is something a little off the rails here. Perhaps the plant does exist only to make Atlas, and maybe both the plant and the missile are wonderful technical achievements and maybe the Americans are a peace-loving nation . . . but surely it is wrong to exhibit little flashes "in lieu of a thermonuclear warhead" and treat the whole thing in a fairground manner?

● It is a fact that in most "survivable" aircraft accidents a forward deceleration is experienced. It is also a fact established beyond reasonable doubt by the R.A.E., and believed by eminent men in aviation medicine and by R.A.F. Transport Command, that when acceleration is substantially fore-and aft, the chances of surviving a survivable accident are higher if the body has the support of a seat, instead of being jack-knifed forward across a safety belt. In other words, that all seats in all airliners should be required by statute to be aft-facing in the best interests of the public.

However, the airlines fit forward-facing seats. Why? Because they think—they do not know for sure, but they *think*—that they might otherwise lose money. Meanwhile the safety authorities, including the Air Registration Board and the Ministry which it advises, prefer not to interfere.

Passing thought: If the Government do not believe that aft-facing seats are safer, why do they prefer civil operators to install them for trooping?

● Yet another American writes to ask why I am always picking on Americanisms, and criticizing such expressions as "as of now." He wants to know why we British say "Bristols" when we mean Bristol, and "de Havillands" when we mean de Havilland. I have discussed this particular point before, and I must agree with my transatlantic friend. I have even heard someone refer to "Lucases." There is only one Lucas, and there is only one Hawker and only one Folland, so let's have no more plurals (or whatever the s signifies). At present only Rolls-Royce is sacrosanct.

Incidentally, up Birmingham way they have their own version. "Does he work at the B.S.A.?" they say.

● Sometimes my travels bring me into the vicinity of Farnborough or Boscombe Down. Then I scan the sky and wonder whether I shall see some entirely new aeroplane. But the thought lasts for only a moment, until I remember that there just aren't any completely new aeroplanes. How different it was in the old days, when secret prototypes seemed to be pouring out of our ears. The heyday, perhaps, came in the period 1939-40, when Bothas, Whirlwinds, Stirlings, Halifaxes, Manchesters, Beaufighters and Tornadoes could all be seen in the circuit at Northolt being demonstrated to V.I.P.s. The prospect today seems bleak in the extreme; even the big ballistic missiles become familiar shapes long before they get into the air.

● The amount of trouble caused by bomb-hoaxes, or—as the Americans call them—phoney bomb tips, is getting pretty serious.

In America a law has just been passed which packs off the phoney bomb tipster—if caught—to prison for five years with a fine of $5,000. I doubt whether that will be much of a deterrent to these miserable cranks, who in the last nine months in America have logged a total of 84 alarms.

As a positive deterrent to hoaxers could not airlines seek the co-operation of the newspapers in ensuring that no stories of airliner bomb-scares ever appear in print? This would at least remove the satisfaction which hoaxers derive from reading about the consequences of their actions. It would also prevent the idea from getting around among other would-be hoaxers.

● For 3,000 million years the moon has been orbiting our planet. For 1,000,000 years *homo sapiens* has wondered at it, gone lunatic under it, made love in the light of it, and written poetry about it. The other Sunday, at lunch time, he took a pot shot at it.

Anyone who was not stirred by this event, or who says that the money should be better spent, or who cynically suggests that the next round should incorporate a juke-box, is a crashing bore.

● Extract from Blackburn advertisement in the *Daily Express*: "The successful flight of the first prototype NA.39 on the target date represents a unique achievement."

ROGER BACON

In this picture there ought to be a Tupolev Tu-114 salesman talking to an Aeroflot official. The caption would read: "This is the standard layout, but of course it can be varied according to your requirements." Isn't it a wonderful photograph? I found it while looking through the latest *Hunting Group Review*: it depicts the day saloon in Queen Victoria's railway carriage of 1863.

(Left) A new air transport era was officially inaugurated on August 15 when PanAm took delivery—four months ahead of schedule—of their first Boeing 707-120, complete with a "provisional" C.A.A. airworthiness certificate. Mr. S. Kauffman (centre) accepts the document from Mr. J. B. Connelly of Boeing. Progress with the DC-8 is self-evident in the picture, right, of the second Douglas jet airliner, painted in United's colours.

CIVIL AVIATION

THE HARD FACTS

THERE have now been two objective analyses of the airline industry's present problems, with particular reference to the economic consequences of the re-equipment programme.

The first was a study, on an international basis, by the air transport committee of I.C.A.O., summarized in *Flight* of August 15. The second, released at about the same time, was an examination of the American airline industry prepared for President Eisenhower by Dr. Paul Cherington, Harvard professor of business administration. The broad conclusions of each study, which were quite independent (their simultaneous release was by sheer coincidence) are the same: that the airlines have ordered too much capacity, and that the financial consequences are likely to be acute.

The Cherington report states that the American airlines are $763 million short of the $4,000 million needed to finance the equipment on order. The trunk airlines are faced with the following financial situation:—

	$
Finance required	4,000m
Available from depreciation	1,400m
From sale of equipment	300m
From profits	500m
From miscellaneous funds	400m
From loans and equity	637m
Finance still to be arranged	763m

This outstanding $763m—which is considerably more than the total common stock of the U.S. airline industry—has still to be attracted if orders are not to be cancelled or "stretched out." Breakdown of the amount required by airlines reveals the following situation: T.W.A. require $313.3m; PanAm, $115.3m; Northwest, $63.5m; Capital, $53.5m; National, $47.5m; American, $31.9m; Delta, $28.8m; Northeast, $26.3m; Eastern, $22.6m; Panagra, $18m; Continental, $17.8m; ($12m was issued as debentures in June 1958); Western, $17.2m; United, $8m; Braniff, nil. Total: $763.7m.

According to the Cherington study, total American airline capacity in 1962 will be between 83,000 million and 92,000 million seat-miles; to utilize this capacity, traffic—which at the moment is not increasing—will have to grow at about 11-13 per cent per year until 1962. "Greater credibility could be given to the carriers' traffic forecasts," says Dr. Cherington, "if they could identify the new customers who will provide the almost doubled volume of traffic." He notes that the necessary traffic growth will not come about "if the only marketing action which the carriers contemplate is price increases." The report questions whether the necessary traffic increases will be forthcoming, and calls upon the airlines to take action to find new markets.

The 43-page Cherington report, and I.C.A.O.'s 54-page study, do not perhaps say much that most airlines do not already know. But their value is that they are objective studies, and that they bring the hard facts out into the open.

The task now before governments and airlines is how best to ameliorate the threatened consequences of an industry's over-optimism, and how, above all, to ensure that the present crisis can never occur again.

C. OF A. FOR THE ELAND CONVAIR

FOLLOWING the announcement that the C.A.A. have certificated the Napier Eland engine comes news that a full airworthiness certificate has now been awarded to the Eland installation in the Convair 340. This event took place on August 22 and was actually the first occasion on which an American C. of A. had been granted to an American turbine-powered airliner. The Electra's C.A.A. certification was not far behind; its award was announced as *Flight* went to press. In the meantime, as noted in the picture above, the Boeing 707 has been awarded a provisional certificate.

Napier's achievement is the culmination of more than three years' effort behind the turboprop conversion of the Convair airframe. Final airworthiness tests were carried out in California. Meanwhile Canadair are progressing satisfactorily with production of the Eland-powered Convair 540 for the R.C.A.F. and, it is hoped, for civil users. A note on the possibility of Convair 540 production in Brazil appears on page 300.

DE HAVILLAND AND THE DIFFERENTIAL

AN important statement by the de Havilland Aircraft Company makes clear the views of that organization with regard to the present discussions about a jet *v.* turboprop fare differential. It has not been issued as a complete statement of policy, but appears in the pages of a summary of D.H. Enterprise activities at the S.B.A.C. Display. The statement reads:—

"The operating costs of the latest (yet obsolete) types in world service and of the propeller-turbine and the jet are so close together that differential fares will be strongly resisted. They would need to be substantial to draw traffic away from the jet. Already there are big fare differentials based on comfort standards. A difference in [direct] operating costs of some 25 per cent or more would be needed to yield even a 15 per cent drop in fare, and one cannot imagine a differential of that order having much effect upon the passenger's choice of travelling by jet, by propeller turbine, or by the old impulse power."

Thus D.H. consider that the margin of difference between the direct costs of propellers and jets is so small as to render it difficult for propeller aircraft to afford reductions sufficient to attract traffic. Their argument—which will be the dominant one among most of the big-jet I.A.T.A. airlines—is: Why penalize jets when they give such a higher standard of service at "competitive" cost?

AMERICA'S NEW AGENCY

FOR a long time Americans have talked about the need to bring their national airspace under the unified control of one agency. When, last April, a U.S.A.F. F-100F collided with a United DC-7 over Las Vegas, the time had obviously come for action. And when, one month later, a T-33 collided with a Capital Viscount near Baltimore, this action—which required a fundamental revision of American air law as well as of the nation's attitude to its air defences—assumed massive proportions.

The result is that Congress has now passed into law the constitution of a Federal Air Agency, which—as proposed by President Eisenhower to Congress—will have the authority to allocate and control all U.S. airspace. This means that eventually military controllers and civil controllers will be unified under this one agency, which will combine the air traffic control functions of the U.S.A.F., the C.A.A., and the Airways Modernization Board. The Administrator has not yet been appointed, but the favourite candidate is Lt-Gen. E. R. Quesada, the President's adviser on aviation.

The F.A.A. represents the first time in history that a nation's military and civil air traffic has been brought under one control.

'Confound percentage thickness chord ratio!..

what price percentage return on investment?'

When the last aerodynamic word has been said, the airline operator still has to consider an aircraft from an economic viewpoint. He will be pleased to find that the Viscount 810/840 is as firmly founded on economic studies as on technical principles.

Its low first cost, low running costs and maximum utilisation add up to profitable operation. The Viscount 810/840 is 50% cheaper than any other four-engined turbo-prop. Although bigger than earlier Viscounts, its air mile costs are unchanged, so that seat mile costs are lower. High payloads will be ensured by the undoubted passenger preference for Viscounts on medium-haul routes.

As the 810, the new Viscount has a cruising speed of 365 m.p.h. With the more powerful Rolls-Royce engines available in 1960, the aircraft will become the 840 with speed raised to 400 m.p.h. The success of Viscounts is based on two important facts. Passengers prefer them — and they produce healthy airline balance sheets.

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

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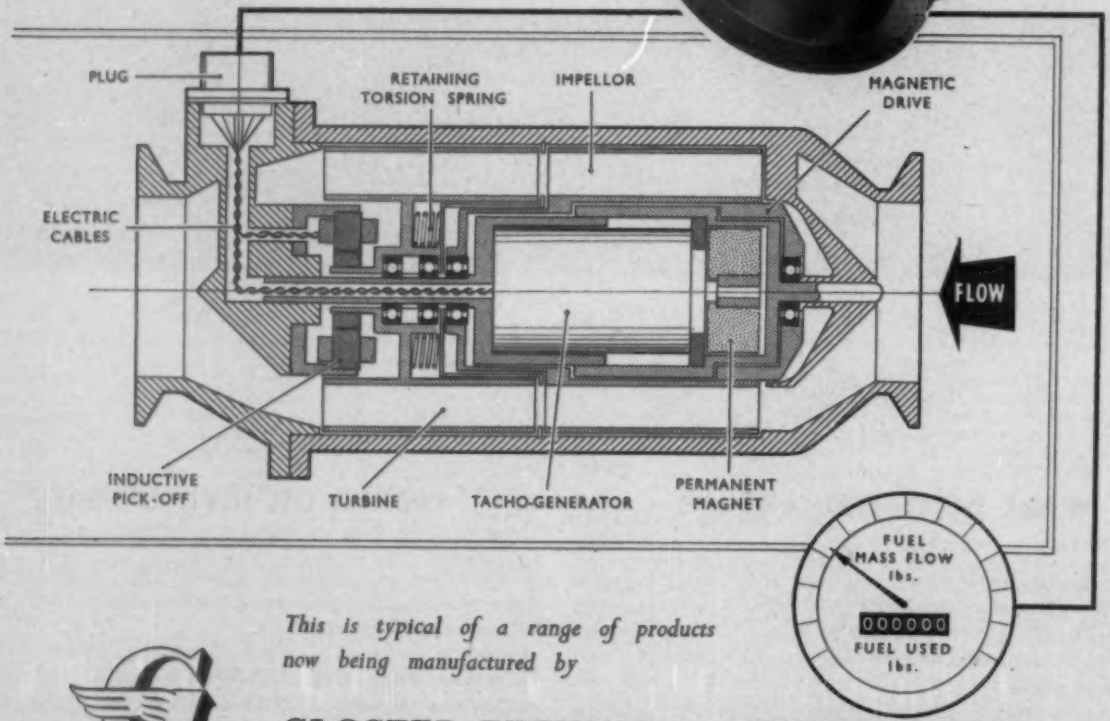
Mass Flow Measurement

for aircraft fuel systems

The Gloster Mass Flowmeter gives a direct reading of mass flow, without the need for a separate device compensating for variations in specific gravity. Operation is based on the angular momentum principle, giving an overall accuracy within 1%. The unit is compact, insensitive to position and external accelerations, and has a low pressure loss. It fails safe, i.e. with no more impedance to flow than when operating. The indicator can be calibrated to suit any flow range and a "fuel used" or "fuel remaining" recorder can be incorporated.

Patents Pending



This is typical of a range of products now being manufactured by

GLOSTER TECHNICAL DEVELOPMENTS

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CIVIL AVIATION . . .

B.E.A. 1957-1958

COMING after the less informative and financially disappointing B.O.A.C. accounts for 1957-58 (reviewed in *Flight* for August 8), the latest report for B.E.A. should give all those interested in British air transport quite a few hours' happy reading. After allowing for all items, the Corporation's net profit has risen from under £¼m on revenue of £24m to over £1m on revenue of £28m.

This heartening improvement can be largely ascribed to three factors: primarily, higher revenue rates (a combination of higher fares and a greater concentration on the more lucrative forms of traffic); secondly, a sharp rise in aircraft productivity (from 767 to 844 c.t.m.s. per hour) as the Viscount 800s replaced Elizabethans on international services; and, thirdly, internal economies, particularly in staff and engineering costs. These three factors have allowed the gap between revenue and cost to widen despite (1) a drop in load factor, from 64.5 to 63.7, resulting from a traffic short-fall in the latter half of the year, (2) a fall in average annual utilization from 1,867 hr to 1,731 hr, reflecting phasing-out of the Elizabethans, and (3) relatively higher charges for fuel, fleet amortization and sales promotion. The main points in the annual report may be summarized as follows:—

Fares. On international services fares were generally increased on May 1, 1957, by 5 per cent. Fares on inclusive tours already arranged for the summer were unchanged, so the average revenue rose by only 4 per cent from 6.14 to 6.4 pence per passenger mile. Domestic fares increased by an average of 5 per cent from 4.92 to 5.16 pence per passenger-mile, as a result of (a) the overall increase introduced in December 1956 at the time of Suez, (b) higher Isle of Man fares as from April 1957 and (c) higher fares between London and Glasgow, Edinburgh and Belfast as from November 1957. (Domestic fare increases ranging between 4 and 25 per cent were introduced in April 1958.)

Average freight-rates on international services increased by 4 per cent by reason of the general 5 per cent rise introduced in January 1957, a further 5 per cent increase introduced in March 1958 having little effect on last year's results. Domestic freight rates went up by 15 per cent in January 1958—the first basic change since 1951. Mail rates remained relatively unchanged. Of future fares-policy the Corporation says: "there is no need in Europe to offer more than two classes of service although present tourist standards should be simplified to allow for fare reductions," and "there should be a fare differential for jet aircraft, at least in their initial period, if existing aircraft types are to continue in service and airlines are to avoid an unnecessarily fast and expensive re-equipment programme which must ultimately result in a higher general level of fares than need be the case."

Traffic. Total load ton-miles rose by 14 per cent, the increase comprising a 17 per cent summer rise followed by a 9 per cent increase in the winter months. Of the total 102m load ton-miles, three-quarters (77m) were international traffic, and one-quarter (25m) was domestic. Passenger-mileage increased by 15.7 per cent from 809m to 936m (the number of passengers rose by 12.4 per cent from 2.5m to 2.8m), freight ton-miles increased 7.6 per cent from 9.2m to 9.9m and mail traffic at 3.6m l.t.m.s showed a marginal fall. Domestic routes accounted for a relatively high proportion of passenger traffic (1.2m passengers, 259m passenger-miles), but relatively little freight and mail (1.2m and 481,000 l.t.m.s respectively).

By far the most important routes are those between London and the Mediterranean (236m passenger-miles, equivalent to one-quarter of all B.E.A. traffic), the second most important area being Iberia and Western France (105m passenger-miles). Five other routes each yielded over 50m passenger-miles—three foreign (Austro-Swiss, 65m; Paris, 61m; Germany, 54m) and two domestic (Scotland, 79m; Channel Islands, 70m).

As a result of expansion by British independents, B.E.A.'s share of total U.K. - Europe traffic fell from 44 to 42 per cent, although on those routes operated in competition with Continental airlines its share rose from 57 to 58 per cent. The most seasonal foreign routes were those between the provinces and the Continent and those to southern France and Iberia, the least seasonal being those to the Eastern Mediterranean, Dublin and Germany and those within Germany.

French import restrictions and the loss of Air Ministry traffic led to freight increasing by only 7 per cent on B.E.A.'s international services while increased charges led to a slowing-down in the annual growth of domestic freight, from 34 to 10 per cent. Mail traffic fell slightly as a result of decreased military mail, increased postal charges and G.P.O. preference for surface transport (partly as an economy measure, partly because of weather delays).

Traffic Services. Various aspects of traffic handling are being studied in an effort to cut turn-round time. Forty separate projects are under way to improve terminal facilities in Europe. There has been further progress in the field of facilitation (including abolition of Britain's former requirement for passenger manifests on European flights). The West London Air Terminal and a new London cargo depot at Chelsea were opened in October. B.E.A.'s Cabin Services Unit was substantially re-organized. Over five million meals were served by the Corporation. The fleet of ground transport vehicles numbered 567 at the year end.

Sales. Travel agents accounted for 61 per cent of B.E.A.'s passenger revenue last year. Overseas traffic has been fostered by consultation with foreign tourist boards and by improved overseas representation. Fresh promotional and advertising ideas and methods, based on marketing research, are constantly being employed. Promotion of inclusive tours took a dominant position in the sales programme.

Routes. B.E.A.'s network now covers 78 points, new routes including those from London to Dublin, Valencia, Belgrade, Prague and Tel Aviv, and from Manchester to Palma, Barcelona and Dublin. Plans were made for new services to Warsaw and Moscow. Viscounts replaced Elizabethans on many routes. Under new arrangements with Cyprus Airways and with B.O.A.C., B.E.A. was enabled to extend its services in the Eastern Mediterranean and to the Persian Gulf.

Operations. At the year-end the B.E.A. fixed-wing fleet numbered 119 aircraft (8 Viscount 806s, 22 Viscount 802s, 25 Viscount 701s, 13 Elizabethans, 44 DC-3s, two Herons, three D.H.89s). Overall annual utilization fell from 1,867 to 1,731 hr, that for V.701s falling from 2,409 hr to 2,383 hr and for Elizabethans from 2,221 hr to 1,696 hr; for V.802s it reached 1,943 hr. Crew utilization also fell (captains, 632 to 613 hr p.a.)—particularly for radio-officers, as a result of the introduction of the two-man-crew Viscount 806. Most of last year's 102 newly recruited pilots came from the R.A.F., but this source "will decrease quite seriously in the future." Last year also saw 69 pilots from other airlines receiving Viscount training, on a repayment basis. Operations control is now centralized in specially designed accommodation in Queen's Building at London Airport; and investigations are proceeding into improving the present system of using manual indicator tabs to show aircraft movements by substituting closed-circuit television.

Engineering. Check cycles were improved during the year; checks 4 for the V.701 and Elizabethan, for instance, were extended respectively from 1,500 to 3,000 hr and from 1,500 to 1,700 hr. Dart overhaul lives were also improved (the 506 from 1,050 to 1,600 hr, the 510 from 750 to 1,250 hr). These improvements led to a reduction in the number of Dart overhauls from 354 to 336, despite an increase in total flying hours. Modifications included work on V.701 flaps and spar booms, and on V.806s to allow increased take-off weight (thus improving on the original range characteristics). Development work included a 60-63 seat V.701 conversion for domestic routes in 1960; the D.H.121 project; three-crew control cabin for the Comet 4B; and various seating configurations.

Helicopters. During the year, says the report, greater emphasis was put on the charter side, but cessation of scheduled operations led flying hours to fall from 995 hr to 904 hr. Early in the year one Whirlwind was sold, leaving four aircraft—two W.S.55s, one Bristol 171 and one Bell 47. The Home Office civil defence contract was terminated in September. Looking ahead, the Bristol 192 should be useful "for the considerable development flying still to be undertaken by a two-engined aircraft" while either the Fairey Rotodyne or the Westland Westminster "may ultimately provide B.E.A. with the economic city-centre to city-centre vehicle which it requires. . . ."

Personnel. At the year end, total strength stood at 11,232 (as against 10,540 a year before) of which 9,993 persons were employed in the U.K. and 1,239 abroad. Staff turnover rate continued to fall, averaging 12 per cent. In October 1957, 119 staff were transferred to Air Terminals, Ltd. The scope of National Sectional Panels was extended to cover monthly paid administrative staff in the salary range £1,120-£1,600. Processes of joint consultation were extended. A general apprenticeship scheme was introduced in October to cover non-technical aspects of the Corporation's work.

Organization and Methods. The O and M Unit undertook 28 assignments last year, 12 of which were major studies including a review of working methods within particular sections of the Corporation. Development work has proceeded on the use of electronic data-processing equipment in reservations and space control, revenue accounting and traffic statistics, and operations control.

Medical. The major responsibility of B.E.A. Medical Services continued to be aircrew fitness. Other work included examination of candidates for employment, study of environmental working conditions, catering hygiene, analysis of health records, medical training and clearance of invalid passengers. B.E.A. continued to operate the Scottish Air Ambulance on behalf of the Department of Health for Scotland.

Accidents. The year was marred by three fatal accidents: an Elizabethan crashed at Munich on February 6 while on a charter flight from Belgrade: a Viscount 802 was lost at Nutts Corner, Belfast, on October 23; and a Heron crashed in Islay on September 18.

The Future. The Corporation "believes that there is a place in European air transport for higher-speed jet aircraft and for more economical turboprop aircraft. B.E.A. plans for the mid-1960s envisage using the D.H.121 on longer international routes where higher speeds show up to greatest advantage, and using the Vanguard on shorter international routes and the domestic trunk routes where operating flexibility is of primary importance. For the interim period there is a clear requirement for a limited jet operation to protect B.E.A.'s competitive position . . . for this reason B.E.A. signed a contract for six Comet 4B aircraft to be delivered in the winter of 1959."

The Report closes with words that should be made compulsory reading for all those responsible for the fortunes of the world's airlines: "It is the determination of the Board (to ensure) that the total level of costs per ton-mile continues to fall. We believe that the whole air transport industry will continue to face this problem of inadequate profit margins until it recognizes that its rate of re-equipment should be slowed down. We are urging the international airlines in I.A.T.A. to give serious thought to this problem. If, with the new generation of aircraft which the airlines of the world have on order, it were possible to extend commercial lives and thus depreciation periods substantially beyond the seven years which is now general practice, the future financial prospects of the whole airline industry would be improved."

CIVIL AVIATION . . .

Four independently owned DC-6As now appear on the British register. Here is one of two recently bought by Hunting-Clan for their Africargo services. Two others have been bought by Eagle from Slick Airways (see brevity in col. 2).

I.A.T.A. v. I.C.A.O.

IT would be a sad event in the history of international air transport if the official bodies representing the airlines and governments came to blows. Although I.A.T.A. and I.C.A.O. for so many years shared the same building, their relationship to each other was not always as close as might be expected. But the fact that the OOrganization has in the past offered advice rather than laid down the law has probably prevented differences of opinion from blowing up to open warfare.

However, the draft memorandum reported to have been prepared by the Association's Montreal staff in response to the I.C.A.O. study on future capacity (*Flight*, August 15) appears to strike an unusually critical note. Not surprisingly, I.A.T.A. feels sensitive about the over-capacity charge—ever since the jet procurement scramble began in 1955, outside observers have been asking two questions: Where is the money coming from? Where is the traffic coming from?

The three main features of the I.C.A.O. report that are singled out by I.A.T.A. are disposal of existing fleets, forecast of future traffic and the relevance of global conditions to individual airlines and regions. In the days and weeks immediately ahead the more vocal airline leaders will be transmitting their views to I.A.T.A. In its final form the memorandum will have to be a very convincing document if it is to be worth publishing.

BOEING 707 LIMITATIONS

MORE commercial significance attaches to the Boeing KC-135 military jet tanker accident at Westover, Mass., on June 27 than has generally been supposed. It is possible that as a result of this accident (in which the aircraft crashed immediately after take-off with the loss of all on board) changes may be made to the take-off technique prescribed for the commercial Boeing 707. As a consequence of these changes, take-off field length requirements may be greater than was expected, with possible aggravation of the take-off weight limitations already likely to be imposed by climb-away (noise) requirements.

It is believed that, at high take-off weights (the KC-135 has been flown at Edwards A.F.B. in excess of 300,000 lb) a ground-stall condition can, in certain circumstances, be experienced.

The U.S.A.F. report on the KC-135 accident is now complete, and is expected to be published next month. The extent to which the findings will affect 707 operators—and PanAm in particular—is not yet known, but it is understood that when delivery of the first 707-120 was made to PanAm on August 15 there were some reservations as to take-off distance and technique.

While it would be unreasonable to suppose that Boeing have suddenly discovered some dangerous fault in the 707, it is probable that strict adherence to a revised take-off technique may now be recommended. What this will mean in terms of payload or fuel-weight limitations at airports which, because of their runways or noise-consciousness, are already 707-limiting, can at present be only a matter of speculation. At the worst, it could mean that PanAm's forthcoming North Atlantic 707-120 operations may be one-stop—and possibly two-stop—services. The 707-120 is already limited for noise reasons to 190,000 lb (max., 247,000 lb) for the present series of scheduled cargo proving-flights out of New York to Puerto Rico.

CANADAIR IN BRAZIL

AFTER negotiations extending over several years, the production of Eland-powered Convairs (Canadair 540s) in Brazil has now, it is reported, been agreed in principle. Financial arrangements are not likely to be settled in detail while Brazil is grappling with the £100,000,000 deficit of a disastrous coffee season, but Canadair—who would build 540s to Brazilian Government orders in a new factory to be built near Sao Paulo—are prepared to go ahead with plans originally laid down by Convair. Canadair took over the negotiations when the American company passed on manufacturing rights (and 32 freight cars full of tools) to its Canadian associate in the General Dynamics Corporation.

Canadair's agreement to share the construction of a new factory with the Brazilian Government is presumably based upon the guaranteed purchase of a fairly substantial number of airframes. REAL have for many months been associated with a Napier Eland conversion for three of their fleet of Convair 340s; and with Panair do Brasil—who a year ago were actively considering re-engining their Constellation 749s with Elands—REAL may eventually decide to purchase new Eland-powered equipment rather than convert their existing fleet. The Brazilian air force is an obvious potential customer for the military version of the Canadair 540.

In October of this year, a joint Canadair and Napier technical sales team is to tour Brazil and other South American countries with the Eland NEl.6-powered Convair 440. Napier are prepared to give Canadair the fullest possible support in becoming established in Brazil; if orders for Canadair 540s are forthcoming, Napier may construct an overhaul base in Brazil that would also manufacture a limited number of the more simple spares.

Both companies have good reason to wish to conclude an agreement with Brazil as soon as possible. Fairchild are very anxious to promote the sales of F-27s in South America, and would also be prepared to construct an assembly plant. Rolls-Royce, as already reported, intend to establish a £1m overhaul base (for Darts and Avons) in Rio de Janeiro. This proposal, a South American correspondent writes, does not altogether find favour with the aeronautical world of Buenos Aires, where Aerolineas Argentinas have their headquarters. This airline, which has ordered Comets, presumably feels that the Rolls-Royce base ought to be in Buenos Aires.

BREVITIES

THE preliminary survey carried out by the Central African authorities suggests that the recent accident to a C.A.A. Viscount at Benina was not caused by malfunction either of the aircraft or of its engines.

* * *

As we go to press it is announced that East African Airways have ordered two Comet 4s.

* * *

A set of Rolls-Royce Conway engines, for installation in the ninth DC-8, is due to arrive at Santa Monica in mid-September.

* * *

The East African Government's Director of Civil Aviation, Mr. Stacey Colls, is appearing in Nairobi on five charges alleging fraud and corruption.

* * *

For the third month American domestic airline traffic in July was below that of the previous year, though the drop was less than one per cent. Load factor, however, was down 5 per cent.

* * *

Aviation Daily reports that Boeing—like Douglas with the DC-8—are now offering a heavier 707 for intercontinental operations. The new weight is believed to be "in excess of 310,000 lb."

* * *

National have grounded all their DC-6s for inspection of suspected fatigue-cracks in the front tailplane spar. Four aircraft have been found defective and Douglas have warned operators to inspect aircraft with 33,000 hours or more.

* * *

Certification programme of the D.H. Comet 4 is now almost complete, and a full C. of A. is likely to be awarded towards the end of September. In the meantime D.H. will carry out overseas proving flights to fly the 100 hr required "under operational conditions." A Comet 4 with a limited C. of A. is expected to be delivered to B.O.A.C. for proving and training during next week.

* * *

The price of Eagle's two ex-Slick DC-6As (see caption) is quoted by the C.A.B. as $1,302,500 and $1,050,300. Both aircraft were acquired by Eagle Airways (Bermuda), but will be operated by the U.K. parent company. One is a new aircraft, and is being furnished and painted at Blackbushe; the other, due to enter service next week, has been refurbished in America. Eagle's application to the C.A.B. for approval of the purchase cited their intended employment as trooping in the Mediterranean. The aircraft will be 98-seaters (all seats aft-facing).

One of the 48 Canberras recently completed for the R.A.A.F. by the Government Aircraft Factories near Melbourne.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Missile Squadron

IT was announced by the Ministry of Defence last Monday that the first R.A.F. squadron "for the purposes of working up operating crews and testing installations" of intermediate-range missiles had been set up in Britain. The first Thor IRBM to be delivered to the U.K. for these purposes is to arrive shortly.

The new squadron, No. 77, is in Bomber Command and its C.O. is G/C. F. A. Willan, who flew during the last war with No. 50 Sqn., winning the D.F.C. before he was shot down in September 1940 and taken prisoner. The squadron under his command will not conduct any test firings, which are being carried out exclusively in the U.S. Its exact location has not been disclosed.

R.A.F. at Farnborough

AN impressive contribution is being made by the R.A.F. to next week's S.B.A.C. show at Farnborough. It will involve [as noted in a news-item on p. 292] over 120 aircraft from three Commands, the largest single element being 45 Hunters and 45 Javelins of Fighter Command, which are to fly-past at 2,000ft or below at a speed of over 450 m.p.h. The "Black Arrows" (Hunter F.6s of Treble-One Sqn.) are extending the spectacular display they gave at Farnborough last year. This time it will start with a massed take-off (from R.A.F. Odiham) and fly-past, followed by formation aerobatics performed by nine and then five aircraft.

Bomber Command's contribution will consist of a tight formation fly-past of three V-bombers, a Vulcan of No. 83 Sqn. leading a Victor of No. 10 and a Valiant of No. 90 Sqn.; nine Canberras from Nos. 9 and 12 Sqns. flying-past in three vics; and two Valiants of No. 214 Sqn. linked together and flying at 1,400ft in a demonstration of air-to-air refuelling.

Four Jet Provosts from the C.F.S., Little Rissington, will do formation aerobatics as Flying Training Command's contribution.

Air Commodore Posts

SINCE January this year Director of Operational Requirements (A) at Air Ministry, A. Cdre. C. M. Wight-Boycott is to be Director of Operations (Forecasting and Planning) from next month. He has been succeeded in his former post by G/C. T. W. Piper (with the acting rank of air commodore), who has been on air plans duties at Transport Command H.Q. since late 1955.

Among A. Cdre. Wight-Boycott's previous appointments have been the command of R.A.F. Colerne (1952) and from 1955 the post of S.A.S.O. in Malta after he had attended the R.A.F. Flying College at Manby. He won the D.S.O. in 1943 for destroying four enemy aircraft during a night raid on London, and a Bar to it the following year. He is also C.B.E.

A. Cdre. Piper commanded R.A.F. Dishforth prior to his Transport Command appointment. In wartime bomber operations he was shot down on a daylight attack over France in 1941 and taken prisoner; he was in charge of flying at Gatow during the Berlin Airlift; and for 2½ years from 1950 he was with M.E.A.F. on air staff planning duties. He is C.B.E. and holds the A.F.C.

Princess Margaret in the co-pilot's seat of the R.C.A.F. C-5 in which she flew over the St. Lawrence Seaway during her recent visit to Canada. With her is the captain, W/C. W. K. Carr.

Below right, Mr. Ian Orr-Ewing, Under-Secretary of State for Air, with his son Colin and F/L. D. B. Hives at R.A.F. Barkeston Heath during the Under-Secretary's recent visit to A.T.C. camps.

R.A.A.F. London A.O.C.

APPOINTED A.O.C. at R.A.A.F. Overseas Headquarters in London, G/C. D. W. Kingwell takes over his new post on September 30 with the acting rank of air commodore. He succeeds A. Cdre. R. F. M. Green, who is returning to Australia to take up a new appointment.

G/C. Kingwell has been Director-General, Organization, at the Department of Air in Melbourne. He was one of the founders (as its original Assistant Commandant) of the R.A.A.F. College at Point Cook; from 1952 to 1954 he was Australian Air Attaché in Washington and then C.O. of R.A.A.F. Amberley (1954-56). During the war, when he flew Hudsons and Liberators in the Pacific theatre, G/C. Kingwell was awarded the D.S.O.

M.R.E.S. Officers' Reunion

THIS year's reunion of M.R.E.S. officers—the tenth—will be held in London on Saturday, October 25. For full particulars members should send a stamped addressed envelope to S/L. P. E. Laughton-Bramley, M.B.E., 18 Cadogan Place, London, S.W.1 (BELgravia 3550).

A.T.C. Welfare Chairman

NEWLY appointed chairman of the Air Training Corps Central Council of Welfare, Mr. W. J. Taylor succeeds Lt-Col. Sir Francis Humphrys, who has held the post since the formation of the A.T.C. in 1941 and has now resigned on the grounds of age. Mr. Taylor, who is Parliamentary Secretary at the Ministry of Supply, has had long associations with the A.T.C.

Medical Services Dinner

THE 1958 annual dinner of the R.A.F. Medical and Dental Branches will be held at the Royal College of Surgeons, Lincoln's Inn Fields, London, W.C.2, on Friday, November 14. Applications for tickets (costing 31s and limited in number) should be made to the Hon. Secretary and Treasurer, R.A.F. Medical and Dental Services Dinner Fund, Air Ministry (M.A.3), 1-6 Tavistock Square, London, W.C.1, as soon as possible. Past and present officers of the Medical, Dental and Medical Technician Branches are eligible to attend.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

B.O.A.C.'s Balance Sheet

TWO million, eight hundred thousand pounds; imagine it, if you can. If not, look at it like this: £2,800,000. Whichever way you write it and however quickly you say it, it's an awful lot of money. Yet this figure was announced with the B.B.C.'s customary calm (and in the same breath as the day's forecast of sunny periods and showers), as the amount lost in the past year by British Overseas Airways Corporation.

A glance through the Corporation's annual report merely aggravates a situation that is already quite intolerable; the blame is placed on the enforced use of unsuitable aircraft and, believe it or not, unjust competition on certain routes from the independent airlines! But one fact cannot be denied or excused: that B.O.A.C. employs 19,344 people for a fleet strength of 83 aircraft, or 233 men per machine.

We know that direct comparisons with other airlines are not necessarily fair, for the ratio must depend on the type of aircraft used, the routes served, whether the company employs its own staff at oversea stations or whether it makes use of agents, and many other factors; but such figures are a guide, and when we find that two of our largest independent operators, Airwork and Hunting-Clan, can reveal a strength of only 35 people behind each aeroplane, we are left with very few doubts about who has carried out some careful planning. Even if we investigate the international airlines of other countries (and surely these form an acceptable yardstick) we still find that B.O.A.C. has a lot to learn—and earn. Air France, for example, can manage with under 150 people per aircraft, while even in the United States, where economy of manpower has never been a strong point, Pan American can run world routes on a man-to-machine ratio of 146 to one.

If B.O.A.C. could offer us a better all-round service than the less-extravagant airlines we could *possibly* excuse its administrators for losing some of our money, but when we have to learn from El Al Israel Airlines how to get our own Britannia into service, when we see large numbers of our Corporation's fleet scattered round London Airport lying idle and (particularly) when a serviceable reserve machine can hardly ever be mustered when required at short notice, we can find no excuses whatsoever for this vast and jumbled maze of nationalized inefficiency.

If B.O.A.C. had been compelled to go into business, it would have been out of it years ago. We must not sit back and accept the chairman's tales of woe and nebulous promises for the future. If the Corporation deserves to have a future at all and to prevent itself from becoming a permanent national disgrace, it must be the subject of a deep-purging public inquiry and we, the taxpayers, must receive an assurance that the staff will be cut by one-third within the next twelve months. If a spot of advice is needed on administrative efficiency and operational economy, no doubt some of the independent airlines would be prepared to lend a helping hand.

St. Albans, Herts. DAVID F. OGILVY.

[The man-to-machine ratio is as much a reflection of the type of operation as of efficiency. In nearly all the major long-haul airlines the ratio is high: Qantas, for example, has over 200 employees per aircraft while Air India employs over 500 per aircraft, and both these airlines are generally considered as being among the most efficient.—Ed.]

Space-Law Priorities

I GREATLY enjoyed Dr. Joyce's excellent survey of the present mess in space politics ["Law of Space," *Flight*, August 15]. In fact I think it was *jolly* good, because he was kind enough to quote several of my own remarks with approbation.

But I am sure Dr. Joyce will not mind my pointing out one area in which he seems to have done me some injustice. At the bottom of col. 1 on page 224, and thereafter, he makes it looks as though I suggested that the No. 1 problem was (a) a multilateral convention on the upper limit for sovereignty and that the No. 2 problem was (b) a code for human occupation and use of the planets. He then goes on to doubt (for very good reasons) that this is the correct order in which to do things. So do I!

In my article [*Flight*, March 28] I emphasized that the order in which problems were tackled was important and I suggested as the No. 1 problem "a code of conduct for human activities in space" and *then* the sovereignty convention. A *convention* for occupation of the planets, etc., was No. 3. In an earlier draft I even thought that, if No. 1 was solved properly, the need for No. 2 might evaporate. I still think this is possible.

London, E.C.2. H. CAPLAN.

The Great Cody Controversy

I DO so agree with Mr. Alan Tomkins (Correspondence, August 8) about first-flight yawns and eye-rolling, but as I am the "defendant" so to speak, might I perhaps have a few last words?

First, I must apologize to Mr. Broomfield: I should have said spring 1909, not winter, as I believe Cody made his first over-a-minute flight on May 14, when he flew "a distance of nearly one mile." But Mr. Broomfield is rather naughty to persist in quoting me as of four years ago, before we made a study of Cody: that is denying me and every other human being the right of revising our opinions in the light of further knowledge.

I am also sorry that he, too, has fallen for the shibboleth about "musty documents," etc., etc., and has brought up the business of eye-witnesses again. If he would study my reports he would see that I, too, rely on eye-witnesses, but eye-witnesses who went off then and there at the time and wrote down what they had witnessed. Distantly retrospective eye-witness accounts are often notoriously suspect, the classic example being Clément Ader. We have a "blow-by-blow," second-by-second, official (and friendly) eye-witness account of his test of October 14, 1897, where it was stated positively that at no time were more than one of the three wheels ever off the ground, as revealed by their tracks. Despite subsequent public utterances by Ader, when he made no claim to having flown, we suddenly find him, *nine years after the event*—when hearing about Santos Dumont—making the fabulous claim that he had flown for 300 metres. *C'est magnifique, mais ce n'est pas la vérité.*

As for Mr. Tomkins' joke about light and heavy machines meeting bumps, let me assure him that there has never in history been a case where an unflyable aeroplane of any weight has hit a bump and then remained airborne for a quarter of a mile.

Finally, may I say that in all these matters, it is only facts that count, and I would welcome a group of independent judges who would be willing to assess the Cody claims.

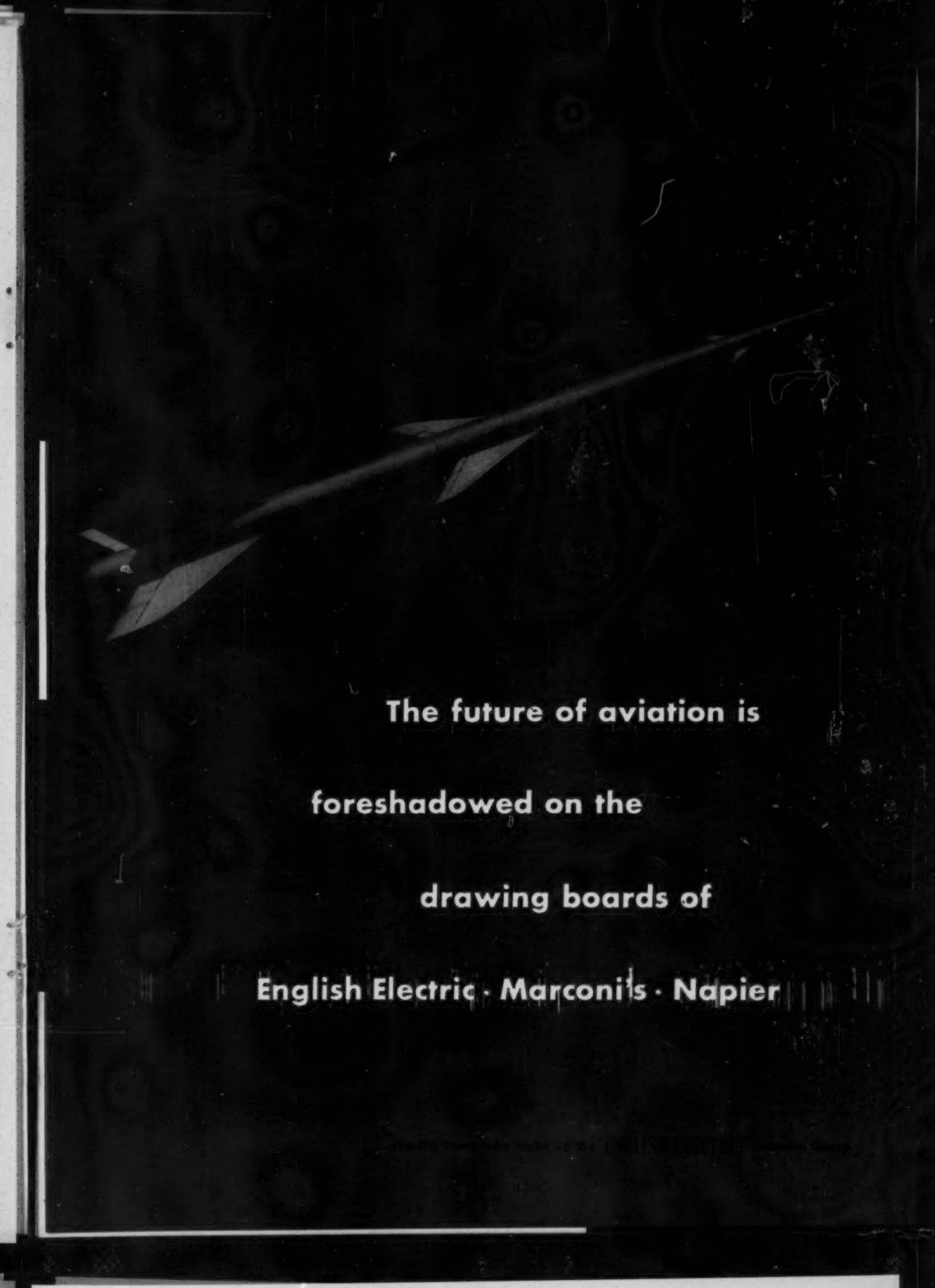
London, W.1. CHARLES H. GIBBS-SMITH.

FORTHCOMING EVENTS

Aug. 30. R.A.F.A.: "Miniature" Air Display, Colwyn Bay.
Aug. 31. Oxford Aeroplane Club: At Home, Oxford Airport.
Sept. 1. S.L.A.E.: "The Engineering Development of Turbine Aircraft," by D. J. Lambert. (At Farnborough.)
Sept. 1-7. S.B.A.C. Display and Exhibition, Farnborough.
Sept. 4. Helicopter Association: Annual Dinner.
Sept. 4-6. AGARD Avionics Panel Meeting, Cambridge.
Sept. 8-13. International Congress of the Aeronautical Sciences, Madrid.
Sept. 15-21. Battle of Britain Week.
Sept. 21. B.G.A.: National Sailplane Aerobatic Contest, Dunstable.
Sept. 21. Royal Belgian Aero Club: 900 cu m Balloon Competition.
Sept. 21. Milan Aero Club: Rally.
Sept. 22-27. A.C.I.M.A.: Third European Aeronautical Conference, Brussels.
Sept. 23. R.Ae.S. Graduates' and Students' Section: "The Next Generation of Civil Aircraft," by G. H. Lee.
Sept. 25-26. Aerodrome Owners' Association: Annual Conference.
Sept. 26-29. Austrian Aero Club: Innsbruck Rally.
Oct. 9. Society of Instrument Technology: "Aircraft Flight Simulators," by Dr. A. E. Cutler.
Oct. 16. R.Ae.S. Graduates' and Students' Section: "The Fatigue of Aircraft," by Major P. L. Teed.
Oct. 20-29. AGARD meetings, Copenhagen.
Oct. 29. R.Ae.S. Graduates' and Students' Section: Annual Film Show.
Nov. 11. R.Ae.S. Graduates' and Students' Section: "The Air Transport Auxiliary," by Sir Gerard D'Erlanger.
Nov. 28. R.Ae.S. Graduates' and Students' Section: Annual Dance.
Dec. 9. R.Ae.S. Graduates' and Students' Section: "The Future of the British Aircraft Industry," by E. C. Bowyer.

R.Ae.S. Branch Fixtures (to December 19):—

Sept. 4, *Halton*, "Physiological Aspects of High-speed Flight," by S/L. T. C. D. Whiteside. Sept. 17, *Coventry*, "Design of Pattern Equipment for an Aero Engine Casting," by K. Marston; *Weybridge*, "The Tyne Engine," by D. McLean. Sept. 22, *Hanlow*, a.g.m. and film show. Sept. 23, *Luton*, film evening. Sept. 30, *London Airport*, "The Boeing 707," by M. Pennell. Oct. 6, *Hanlow*, "Mixed Powerplants," by M. J. Brennan. Oct. 8, *Weybridge*, "Physiological Aspects of High-performance Flight," by Dr. K. G. Williams. Oct. 21, *Luton*, "Fatigue Testing of the Fokker Friendship," by E. J. van Beek. Oct. 29, *Weybridge*, brains trust. Nov. 4, *Luton*, "Guided Flight," by L. H. Bedford. Nov. 18, *Luton*, discussion evening. Nov. 19, *Weybridge*, "Training of a Production Engineer for the Aircraft Industry," by Professor J. Loxham. No. 21, *Luton*, annual dinner. Dec. 2, *Luton*, "Satellites," by E. M. Dowlen. Dec. 10, *Weybridge*, R. K. Pierson Memorial Lecture, by B. S. Shenstone. Dec. 19, *Weybridge*, annual dance.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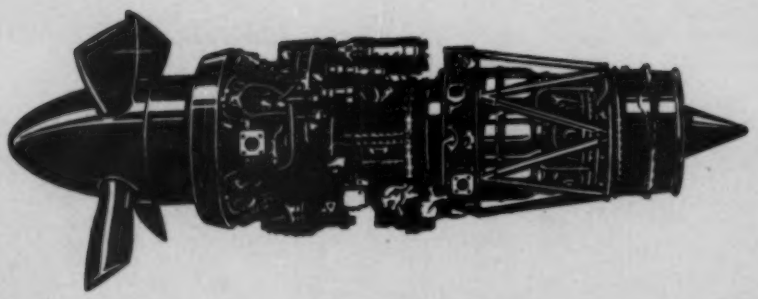
NAPIER ENGINES MAKE NEWS



ELAND N.EI.3

Designed for rotary wing aircraft and powers the Fairey Rotodyne V.T.O. airliner, right, providing power for forward flight and compressed air to the rotor tip combustion jets for vertical flight. Another version of the Eland, the 229, powers the twin-engined Westland Westminster helicopter, left.

Lion powered Gloster 'Mars I'
Winner Aerial Derby, 1921, 1923

Lion powered Supermarine S.5
Winner Schneider Trophy, 1927

Rapier powered Short 'Mercury'
Long Distance Seaplane Record, 1938

Typhoon, fitted with the "Sabre".
World's most powerful piston aero-engine, 1941

Double Scorpion Canberra
World Aeroplane Altitude Record, 1957

NAPIERS have been making famous aero-engines from the earliest days of flying. On every page of the history of the aircraft industry you will find memorable achievements made possible by the imagination of Napier engine designers and the skill of Napier engineers. Today the world sees the continuation of the Napier story in such advanced engines as the Eland for fixed and rotating wing aircraft, the Gazelle helicopter power unit and the Scorpion range of aircraft rocket engines for increased performance at very high altitudes.

ELAND N.EI.6

Single shaft turbo-prop aircraft power unit of exceptional operational stability and safety for the Canadair 540, left, and piston-engined aircraft conversion.

GAZELLE

Free turbine engine for helicopters—e.g. the Westland Wessex helicopter—with compressor and fuel injection system designed for automatic peak efficiency at all power settings. The Gazelle also powers the Bristol 188 flying test bed for the R.A.E.

DOUBLE SCORPION

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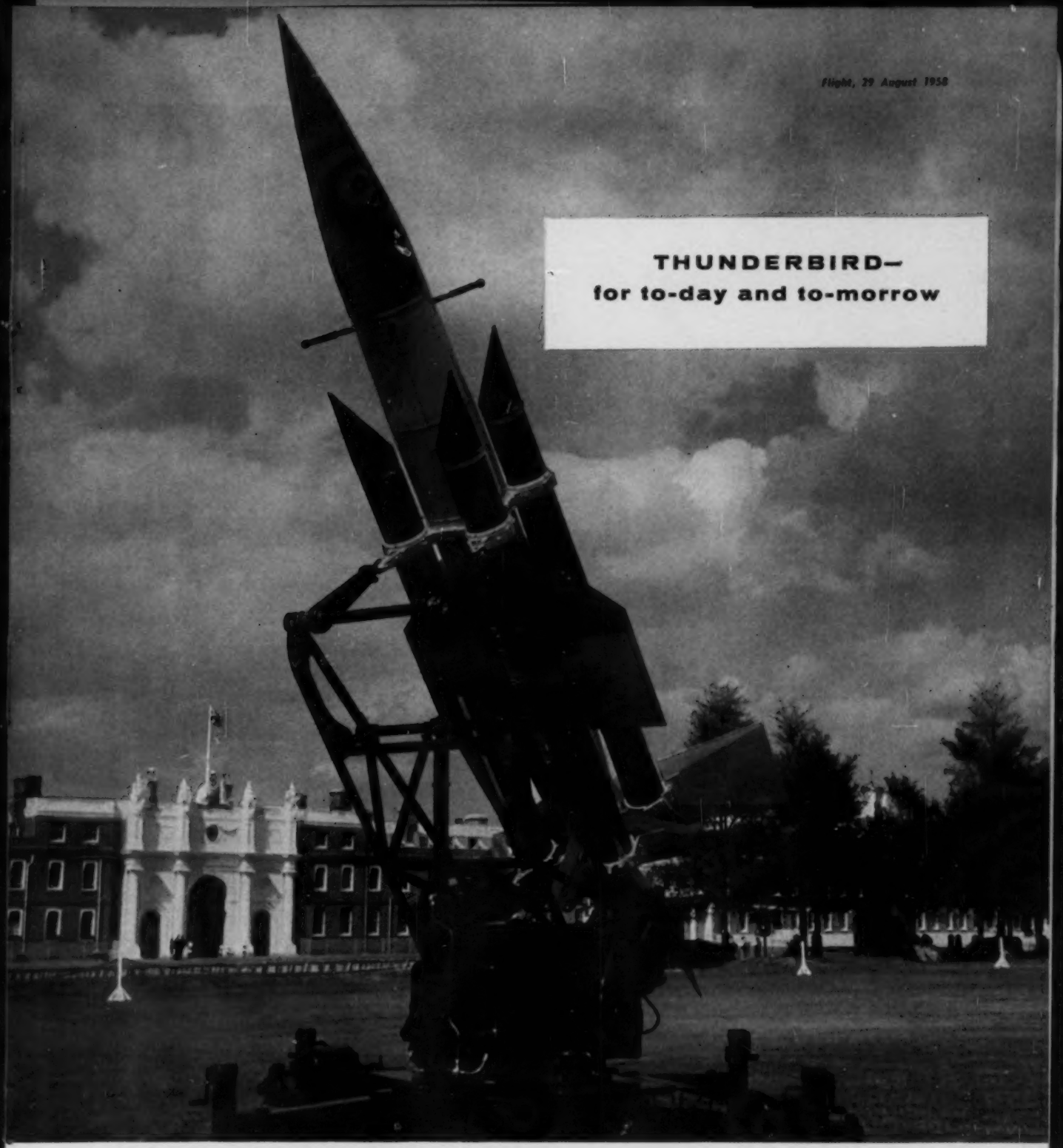
ENGLISH ELECTRIC



THUNDERBIRD—
for to-day and to-morrow

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Baginton, nr. Coventry. Telephone: Tollbar 2261

Sea Hawk Still the standard carrier-borne day fighter in the Fleet Air Arm and Royal Dutch Navy, late marks of the Sea Hawk are now being delivered to the German Navy. The first German squadron has been formed.

Powered by a Rolls-Royce Nene turbojet, delivering 5,400 lb-thrust through its twin nozzles, the Sea Hawk FGA.6 has given a good account of itself and has in several respects proved superior to comparable swept-wing types of foreign manufacture. In addition to the fixed armament of four 20 mm guns, it can carry offensive stores or external tanks on three pylons under each wing. A representative load would include two 75-gal tanks inboard, two 500 lb bombs and either two tiers of two 60 lb rockets or two tiers of three 3in rockets.

Exported Sea Hawks are designated Mk 100 and Mk 101. Delivery of 30 to the Dutch navy was completed ahead of schedule last year and 68 are on order for the German navy. The latter machines are characterized by a redesigned tail. All recent Sea Hawks have powered ailerons.

AW. 650 Argosy This is the newest product of Britain's civil aircraft industry; the first example is due to fly before the end of 1958.

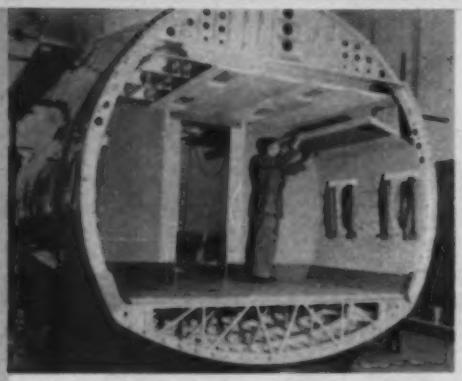
The Argosy falls into a distinct class: it is a turboprop transport designed specifically to bring down the cost of air freight—a market which has a very big potential provided costs can be cut. Thus it was designed from the start to embody all the classic requirements of a modern freighter —front and rear axial-direction loading; strong floors and lashing points at truck-bed height; large volume (3,680 cu ft) and floor area; and of course pressurization.

But, aware that the airline industry is as yet not generally inclined towards all-freighting, Armstrong Whitworth have designed the Argosy to be readily adaptable to passenger-carrying work as well, and comfortable accommodation can be provided for up to 83 passengers. Thus the aircraft is a "convertible" in the sense that it continues the trend embodied in the DC-6A and the L.1049H—but is essentially a freighter in design and not a modified passenger-carrier. In one aircraft, there-

Armstrong Whitworth Sea Hawk Mk 100/101

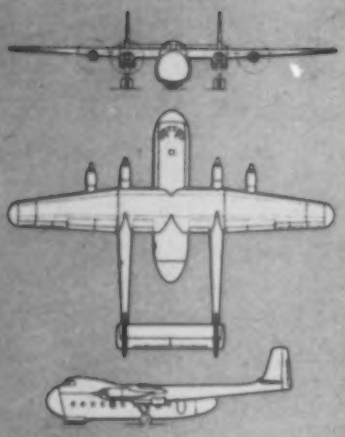
Powerplant	Rolls-Royce Nene
Span	39ft
Length	39ft 7in

British Aircraft 1958



A section of Argosy fuselage.

Artist's impression of the AW.670 Airbus.

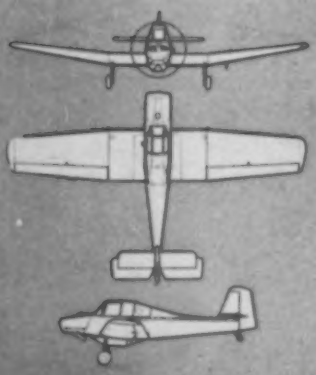


Armstrong Whitworth AW.660 Argosy

Powerplant	Four Rolls-Royce Dart 526
Span	115ft
Length	86ft 9in
Gross weight	82,000 lb
Typical cruising speed	280 m.p.h.

Auster B.8 Agricola

Powerplant	Continental O-470
Span	42ft
Length	27ft 6in
Gross weight	3,898 lb
Cruising speed	Up to 123 m.p.h.



fore, the airlines can buy all the essential amenities of freighting, plus the passenger comfort and smoothness of a Viscount.

A.W.A.'s choice of the Rolls-Royce Dart 526 for the Argosy made obvious sound sense: the R.-R. Dart is accepted throughout the world, and is already backed by more than four million hours in scheduled service. The version fitted to the Argosy is virtually identical to that in the Viscount 810.

The Argosy fulfils two particular requirements which today face operators and manufacturers. It is an aircraft which is not likely to be rapidly outpaced by technological progress, and which can therefore look forward to a long-term demand for its services; and it is being wholly financed as a private venture by the Hawker Siddeley Group, of which A.W.A. is a member. Total cost of the Argosy programme, which includes the speculative manufacture of ten production aircraft, is likely to be of the order of £10m. The fact that it is in production already on such a scale means that, in a calculated gamble, Hawker Siddeley have broken the old vicious circle of "no orders-no production-no orders" known so well to the British aircraft industry. Armstrong Whitworth anticipate that the first three aircraft will be flown in quick succession, and will embark immediately on airworthiness trials; the fourth aircraft will be demonstrated at the Paris Salon next June, after which it will undertake a round-the-world sales tour; and deliveries of the fully certificated production aircraft can be made in the early part of 1960—i.e., 18 months hence.

Payload accommodation for freight consists of the whole floor area in between the large fore and aft doors. When both these are opened (110 deg) loading and unloading operations can be performed simultaneously, the floor sills being 4ft off the ground. The minimum height in the cabin is 6ft 8in. The space contained by the front and rear freight door shells is devoted in each case to baggage and lavatories. When the aircraft is being used in the passenger rôle, the seating capacity offered varies between 71 at 38in pitch, and 83 at 32in pitch. The main passenger entry door is in the accepted position on the aft port side.

Total fuel tankage of the Argosy is 3,300 Imp. gal; max. payload is 28,000 lb, and max. range with 9,450 lb and no reserves is 2,800 st. m.

By virtue of its twin booms, the basic Argosy is obviously adaptable to the fitting of almost any kind of payload container. In fact two particular variants have so far been designed (see below) and studies are in hand for a twin-Tyne configuration.

AW. 660 This is similar to the 650 except for its "beaver-tail" layout, which transforms the aircraft into a military transport capable of dropping both fighting equipment and troops. (This version also offers the facility of ramp-loading.) The AW.660 is at present being seriously considered for R.A.F. Transport Command.

AW. 670 Named Airbus, this is an unpressurized, increased-capacity 650 variant intended for use either as a vehicle ferry (accommodating six cars and, on an upper deck, their passengers) or as a short-range, very high density passenger airliner. Accommodation for 126 passengers is possible.

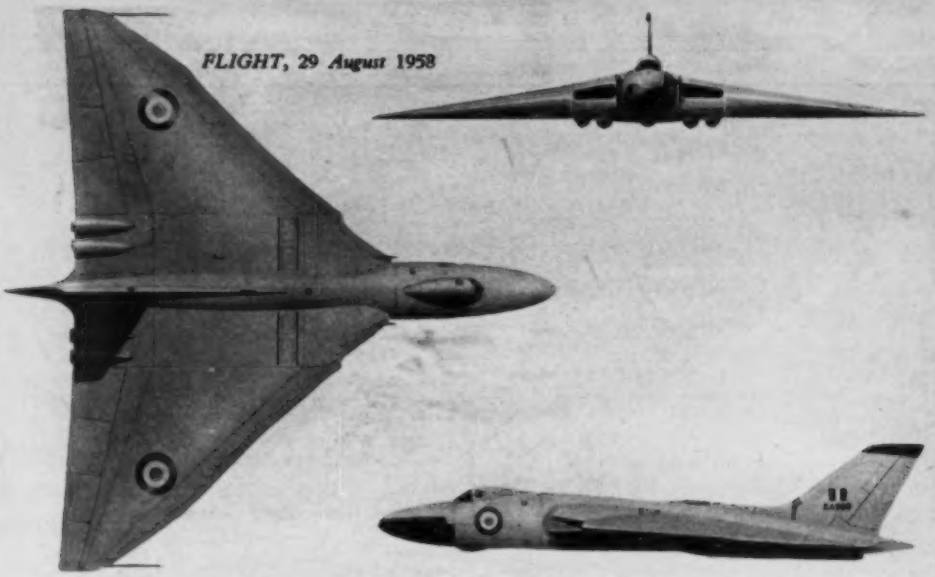
Auster Aircraft, Ltd.

Rearsby Aerodrome, nr. Leicester. Telephone: Rearsby 321

A range of half-a-dozen different types of Auster light commercial aircraft is available. Most recent development is the **Workmaster,** an agricultural aircraft powered by a Lycoming O-360-A engine of 180 h.p. Oversize tyres give particularly good behaviour on soft ground. A 90-gal spray tank is fitted, and there is space for one passenger. The popular **Aiglet Trainer,** for sporting and club use, will be shown at Farnborough in the colours of its most recent purchaser, the Iran Flying Club. The **AOP.9** military observation machine, and the **Agricola** all-purpose agricultural aircraft, are in production; recent deliveries include an aircraft to South America and one for Crop Culture, Ltd. The **Alpha** general purpose sprayer will be seen at the show fitted with Britten-Norman spray-gear. The **Autocar** four-seater is a tourer adaptable to agricultural needs. Both the last two types have Gipsy Major engines, the Alpha having a Lycoming as an alternative.

Auster AOP.9

Auster Workmaster.



Avro Vulcan B.1 (left)
Powerplant Four Bristol Olympus [illegible]: 104
Span 99ft
Length 97ft 1in

Avro Vulcan B.2 aerodynamic prototype (below)
Powerplant (production B.2)
Four Bristol Olympus 200-series
Span 111ft

A. V. Roe and Co., Ltd.

Greengate, Middleton, Manchester. Telephone: Failsworth 2020

Vulcan B.1 Now in service with three squadrons in No. 1 Group, Bomber Command, the Vulcan B.1 is an important member of the V-force. The largest delta-winged aircraft in service in the world, it is capable of very high subsonic speed and can climb to heights in the region of 50,000ft. Its very large bomb-bay can accommodate either conventional or nuclear bombs, both of which can be delivered with the aid of a radar-controlled blind-bombing system. The crew of five, consisting of two pilots, navigator/plotter, navigator/radar operator and air electronics officer, are accommodated in a pressurized cabin forward of the wing leading edge. Ejection seats are provided for the pilots, but, as with the other V-bombers, the three crew-members sit facing rearwards in fixed seats. They would escape from the aircraft by jumping through the main ventral access-hatch.

A Doppler radar and computer, together with astro sextants and other aids are carried for navigation; and probe and drogue flight refuelling is a standard fitting to extend the striking range of the aircraft. H.F./R.T. radio affords direct voice communication with ground stations almost anywhere in the world; and this can be directly connected to a normal telephone system to permit man-to-man communication between the pilot and, for example, the A.O.C-in-C. Bomber Command. Such contact has indeed been made between San Francisco and England.

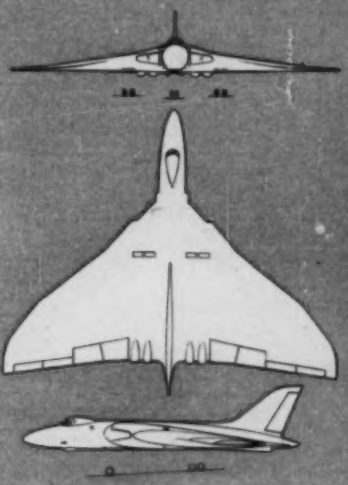
Progressively more powerful Bristol Olympus turbojets have been fitted to various groups of aircraft in the production run, the most powerful delivering 13,000 lb thrust. All flying controls are fully powered by electro-hydraulic units, safety being ensured by the division of ailerons, elevators and rudder into two independent sections. Artificial feel is provided for all axes by springs whose datum is varied according to airspeed signals.

The Vulcan has shown a remarkably good serviceability record from its earliest days in service; and two Vulcans put up a creditable performance in the Strategic Air Command annual bombing and navigation competition at Pinecastle A.F.B., Florida, in 1956.

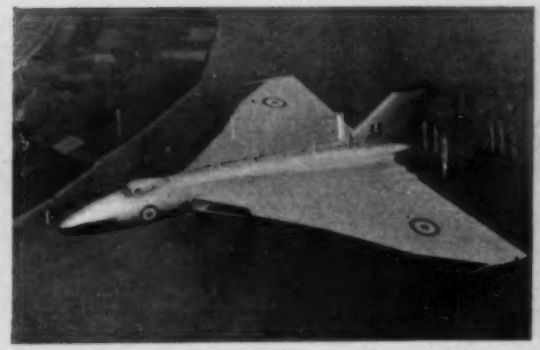
A detailed description and cutaway drawing of the Vulcan, together with a history of its development, appeared in *Flight* for January 31; and an account by a *Flight* representative who flew in a Vulcan of No. 101 Sqn. during a bombing exercise appeared in *Flight* for July 18.

Vulcan B.2 Considerably increased range and performance are features of this substantially modified Vulcan. Bristol Olympus 200-series engines, which have been type tested at a thrust of no less than 17,000 lb, will be fitted. Deliveries to operational squadrons should begin in the not too distant future. An aerodynamic prototype of the B.2, having a considerably extended wing with a more pronounced leading-edge extension and a slightly swept trailing edge, was seen at the S.B.A.C. display last year. Many other changes are incorporated in the definitive B.2. A feature of the B.2 wing is that all the trailing-edge control surfaces act as elevons and are not divided into ailerons and elevators.

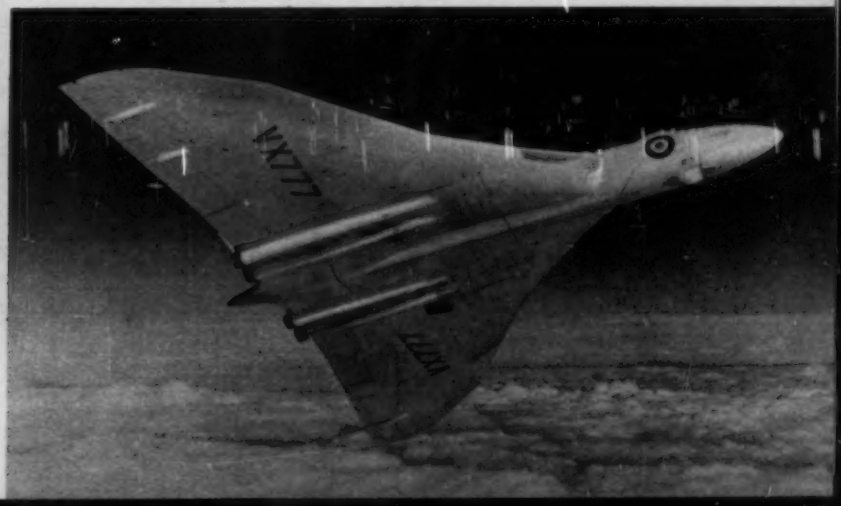
A potent addition to Vulcan armament will be the Avro stand-off bomb, some details of which are recorded on p. 345. Vulcan B.1s will probably also be modified to carry this weapon at a later date.



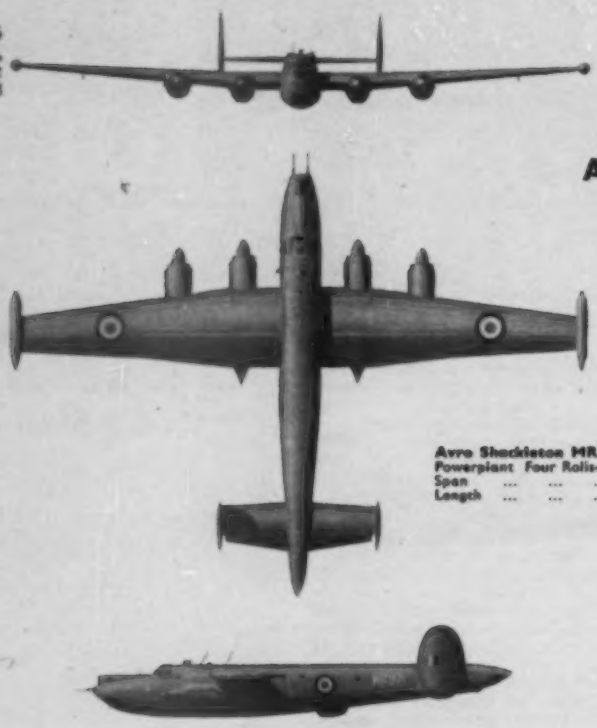
Avro Vulcan B.1.



Avro Vulcan B.2 aerodynamic prototype.



British Aircraft 1958



Avro Shackleton MR.3
Powerplant Four Rolls-Royce Griffon 67
Span 120ft 6½in
Length 87ft 4in

Shackleton MR.3 This latest version of the Shackleton is now in service with R.A.F. Coastal Command and with the South African Air Force. With its nosewheel undercarriage, increased sound-proofing, cross-over engine exhausts and tip-mounted external fuel tanks, the MR.3 offers a considerable improvement over its predecessors, the MR.2 and MR.1. From western England, Shackletons can range half-way across the Atlantic; and they are also cleared for carrying over a score of troops, a task which they have on several occasions been called upon to perform.

Four Rolls-Royce Griffon engines provide ample power and height can be maintained, it is reported, on two engines. Offensive stores include bombs, torpedoes, depth charges and sonobuoys in addition to high-powered search radar. Rescue containers and markers are also carried.

Blackburn NA.39
Powerplant Two de Havilland Gyron Junior
No other information available.

Blackburn and General Aircraft, Ltd.

Brough, East Yorks. Telephone: Brough 121

NA.39 Although considerable American financial support has gone towards the development of the NA.39, this new Naval strike aircraft represents the English approach to the present carrier-borne strike requirement. Designed to fly at sea level over considerable ranges at a speed probably between Mach 0.95 and 1.0, the NA.39 accommodates a pilot and navigator in tandem and carries either conventional or nuclear stores in an internal weapon bay. The powerplant is two de Havilland Gyron Junior engines, each giving a thrust in the region of 7,000 lb. These engines are mounted forward of the leading edge and faired into the flanks of the fuselage which is itself markedly area-ruled.

In order to meet the difficult requirements for such aircraft it appears that extensive use has been made of boundary-layer control in the form of super-circulation, the multiple jets of super-sonic air being expelled close to the leading edges and over the top of the flaps and ailerons. The air is derived from a bleed manifold on each Gyron Junior.

The main undercarriage units, carrying large single wheels, have levered suspension and retract inwards to lie immediately under the jet-pipes. The nosewheel retracts rearwards. Variable-incidence tailplane and elevator are mounted on top of a wide-chord fin which blends with a dorsal spine running right forward to the canopy. Airbrake surfaces are embodied in the fuselage tail-cone which splits open to form two large brake panels. Fences and vortex-generators maintain the effective cross-sectional area despite the curved profile.

Because the NA.39 must be able to perform such manœuvres as toss-bombing at near-sonic speeds, the structure is extremely strong, and the

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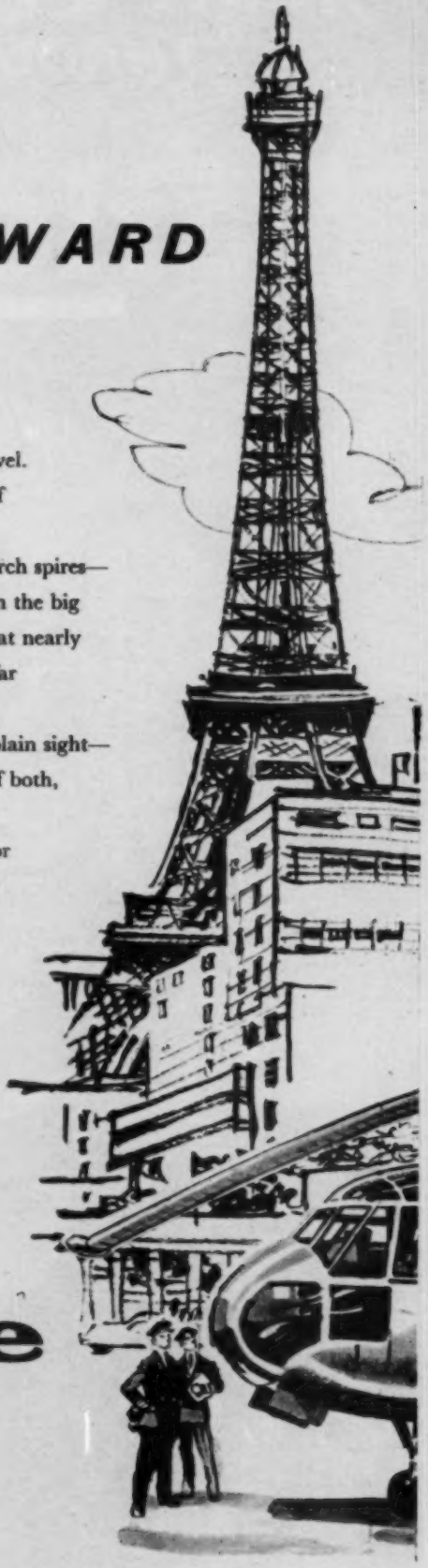

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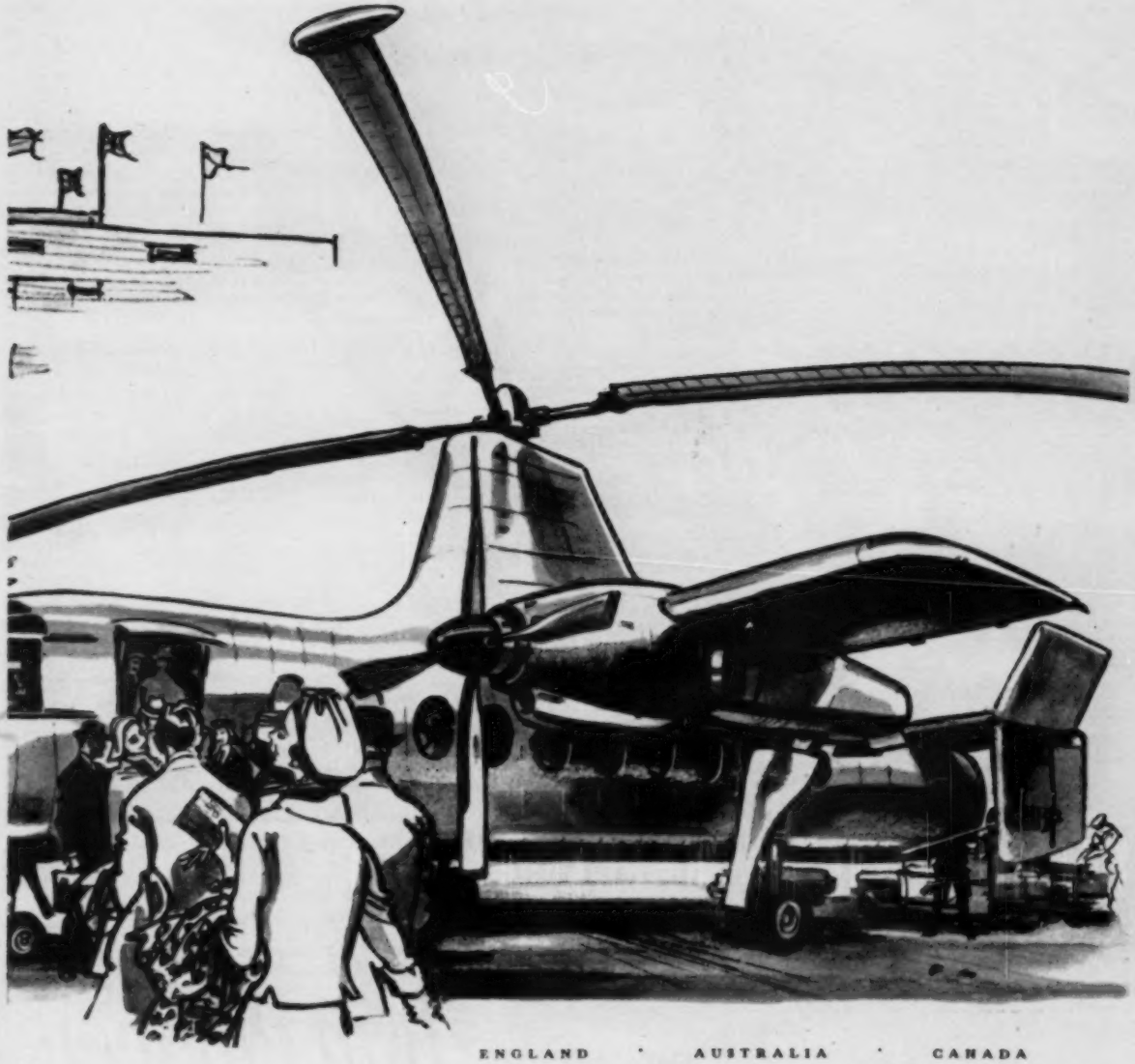

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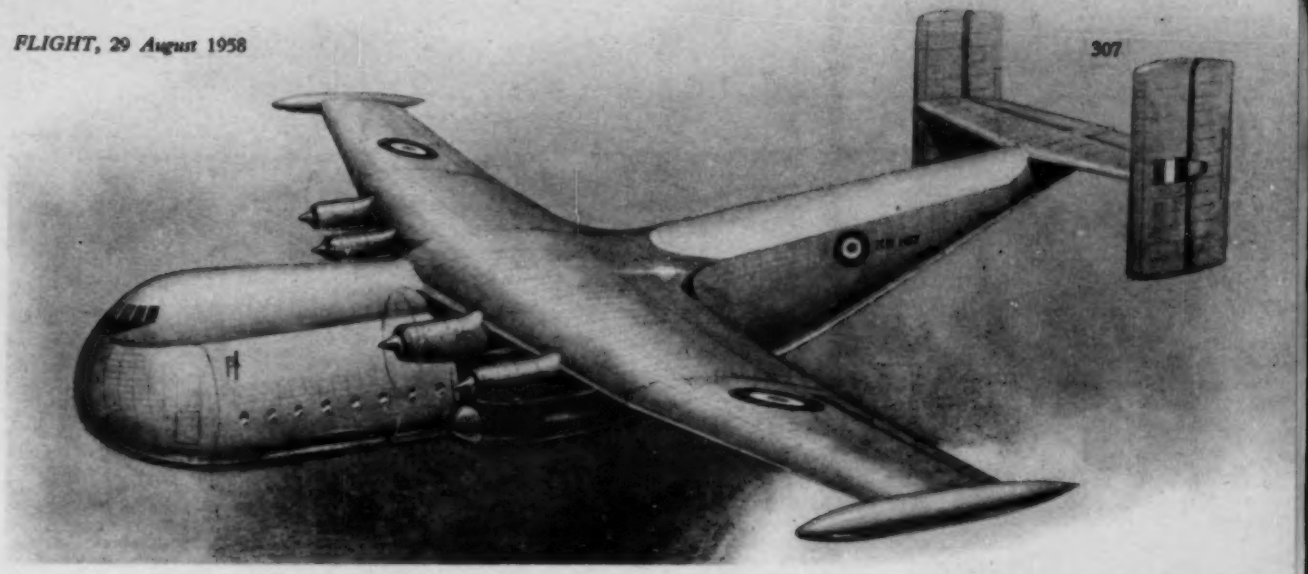
POWERED BY ALVIS LEONIDES ENGINES
FITTED WITH DE HAVILLAND PROPELLERS



wing is probably based on a number of spars and integrally stiffened, machined skin panels. The wings (and possibly the nose) of the aircraft are arranged to fold for carrier stowage.

It seems logical to suppose that, although the NA.39 carries an elevator surface, the whole tail-plane-elevator group is normally locked to form a slab control. The elevator is probably unlocked to serve as a follow-up and trimming surface when the undercarriage is lowered. For an aircraft the size of the NA.39 there is at present a limiting deck-landing speed in the region of 130 kt, which is dictated by the strength of the available arrester. gear. Moreover, the aircraft must during the approach have a margin of some 30 per cent over the unaccelerated stalling speed in order to allow proper control and manœuvring dictated by the mirror landing-aid. Boundary-layer control will probably allow this margin to be reduced to something like 10 per cent. In order to obtain maximum blowing, full engine power is probably applied and very effective drag devices are needed to counteract excess thrust. This accounts in part for the size of the tail-mounted airbrakes. There is no firm indication that the leading edge of the wing can be cambered for the approach.

It is reported that the U.S. Navy is investigating the possibility of adopting the NA.39 as a strike aircraft; and it is worth noting in this context that the NA.39 differs radically in its "mission profile" from the North American A3J. The latter machine is designed to cruise at supersonic speeds at high altitudes and to descend to lower levels only during the immediate attack phase; but, like the NA.39, it carries a crew of two and search radar, and has internal stowage for weapons. The A3J is, however, a good deal larger than the NA.39, being designed for operation from *Forrestal*-class carriers. Such extensive deck space and handling capacity is, of course, not available in any British carrier.

The NA.39 is undoubtedly intended for operation from carriers the size of H.M.S. *Victorious*. Very little information has yet been officially released, but a study by the Technical Editor appeared in *Flight* for May 9. The prototype made its first flight from R.A.E., Bedford, on April 30 in the hands of Derek Whitehead.

B. 107A It has been known for a year or more that Blackburn and General Aircraft, makers of the Beverley transport in service with the Royal Air Force Transport Command, were working on the design of a turboprop development of this aircraft. Together with other projects, this Beverley development—the B.107A—is the subject of close examination by the British Government, whose object is to give effect to the policy outlined in the Defence White Paper of 1957—"the Central Reserve [i.e. the British Army and its heavy fighting equipment] must possess the means of rapid mobility."

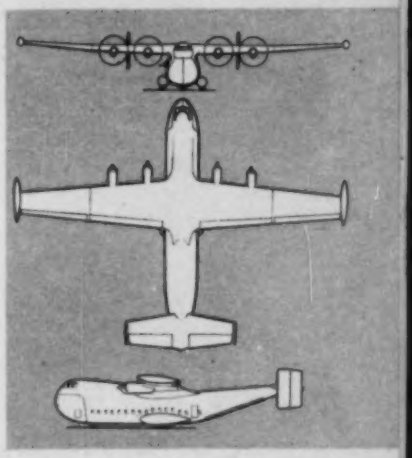
Blackburn's objectives in designing the B.107A, which is powered by four Rolls-Royce Tynes, were to provide in one aircraft the combination of short-field performance and parachute-dropping capability with the speed and range necessary for long-range strategic transport. The Beverley fulfills the first of these requirements, but not the second.

Operating from a typical airfield, the B.107A is designed to carry a payload of 40,000 lb for a distance of 2,550 n.m. at 310 kt. The maximum payload of 58,000 lb can be carried 1,300 n.m., whilst fuel capacity permits a maximum stage distance of 4,400 n.m. On the score of field performance, the 107A can operate off 2,400-2,700ft strips with a 30,000 lb payload and fuel for 1,600 n.m.

Main loading doors are forward; rear doors can be operated in flight for parachute dropping. The wing and empennage are existing Beverley units, a factor which should ensure considerable economies in development time and expenditure.

The fuselage has a total volume available for freight or passengers of 12,883 cu ft. The main freight floor is 12ft 6in wide, and has an overall strength of 250 lb/sq ft; local loadings of 3,600 lb/sq ft can be accepted. Pressurization is provided, the maximum differential pressure being 6.5 lb/sq in.

Beverley C.1 Three squadrons of this type are in service with the R.A.F. and have done excellent work in many parts of the world. Particularly valuable is the C.1's ability to lift heavy and bulky loads from small fields. Vehicles, equipment or partly dismantled aircraft can be transported; and a load of 29,000 lb has been successfully parachuted with eight G.Q. 66ft parachutes. Troops can be carried in the tail boom and paratroopers can jump either from this cabin or from the main hold. The Beverley is powered by four Bristol Centaurus piston engines.

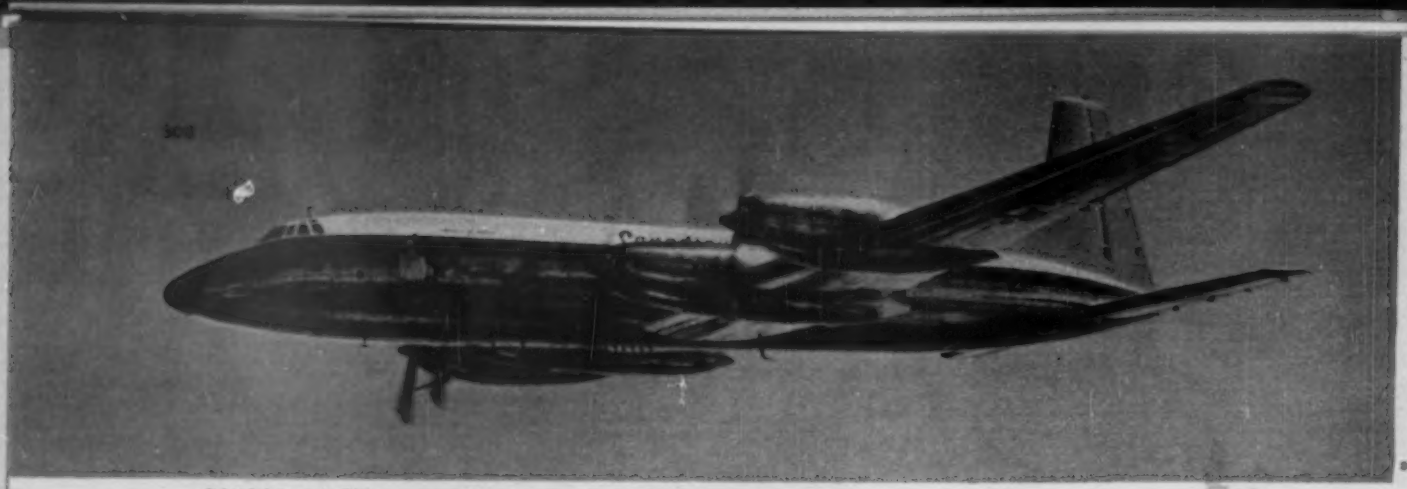


Blackburn B.107 (drawing and artist's impression above).

Powerplant	... Four Rolls-Royce Tyne
Span	...166ft 8in
Length	... 124ft
Gross weight	175,000 lb
Cruising speed	350 m.p.h.

Blackburn Beverley C.1 (photograph below)

Powerplant	Four Bristol Centaurus 173
Span	162ft
Length	... 99ft 5in
Gross weight	135,000 lb
Cruising speed	175 m.p.h.



Bristol Britannia 314.

Bristol Aircraft, Ltd.

Filton House, Filton, Bristol. Telephone: Filton 3831

Britannia 320 Series This newly announced development of the standard production Britannia incorporates a number of improvements on the 310 series, in particular with regard to its powerplant. The version of the Bristol Proteus which is fitted to the 320 is the 765, developing 4,445 e.h.p. compared with the 4,120 e.p.h. of the 755. All differences between the 320 and the 310 are mostly of a kind that can be progressively incorporated on the 310 production line; and it is likely that later 310 deliveries will be at the weight, tankage and modification standard of the 320 specification, which includes all alterations necessary for compliance with American airworthiness requirements.

The 320 is in fact a refinement of the 310, incorporating the experience of more than 70,000 hours of Britannia airline operations. To date Britannias have been in service with B.O.A.C. (15 Britannia 102s, introduced on February 1, 1957, and 18 Britannia 312s, all but two of the latter having been delivered); El Al, three Britannia 313s and one 300-series on lease from Bristol until delivery of a fourth 313; Canadian Pacific Airlines, six Britannia 314s; Aeronaves de Mexico, 2 Britannia 300-series; Air Charter of London, 1 Britannia 300-series. Other commercial operators still awaiting delivery are Hunting-Clan, two 317s; Cubana, four 318s; a British independent under trooping contract to the Ministry of Supply, three. Total number of Britannias of all types now delivered or on order amounts to 76.

Main production at present is for Royal Air Force Transport Command, for whom 20 series-250 aircraft are in production. These are military versions of the commercial airliner, differing notably in the provision of a strong floor for freight and heavy equipment, and an enlarged forward freight-loading door. The manufacture of these aircraft is the responsibility of the second-source Britannia production line of Short Brothers and Harland, Ltd., at Belfast. Deliveries to the Britannia squadron of Royal Air Force Transport Command will permit operations to begin in April next year; the contract for all 20 aircraft should be completed by about October, 1960, i.e. at a rate of about one aircraft per month.

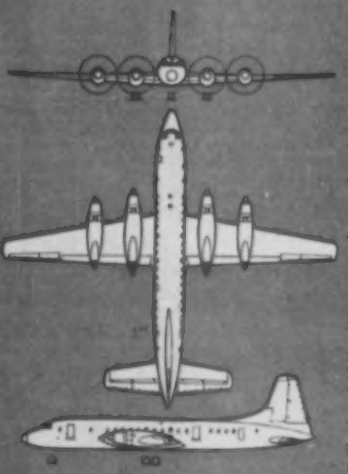
Further development of the Britannia depends upon the potential of the Proteus turboprop, and also to a considerable degree upon the airline industry's recognition of a need for two basic price levels in air transport, not so much to reflect differences in the operating cost of turbojets and turboprops, but more to reflect the difference in the quality of service which each offers. So far as the Proteus is concerned, Bristol Aero-Engines can foreseee as a commercially feasible prospect take-off powers of 5,000 h.p. The record of this engine in airline service ever since the early icing difficulties were mastered has been remarkable: within 18 months of its entry into scheduled airline service in February, 1957, the Proteus 705 engine of the Britannia 102 attained a life-between-overhauls of 1,600 hr, with trials currently proceeding towards an early extension to 1,900 hr. This record has not been achieved by any other engine in airline service, and is particularly noteworthy in view of the fact that the Proteus is the most powerful engine in airline service in the Western world.

Total fuel capacity of the Britannia 320 is 8,580 Imp. gal, distributed as follows: centre tank, 1,230 gal; inboard tanks, 1,670 gal; outboard tanks, 1,545 gal. The maximum-payload stage length of the 320, with fuel reserves, is more than 4,500 st. miles. Maximum payload capacity, as in the 310, is 28,000 lb; and standard seating accommodation is for 110 passengers six abreast. Maximum economy class seating layout provides for 133 passengers. The total capacity of the two main underfloor freight holds amounts to 829 cu ft (386 cu ft forward hold, 443 cu ft rear hold). The cabin and the freight holds are pressured to a maximum differential pressure of 8.3 lb/sq in, permitting a cabin altitude of 6,000ft to be maintained at a cruising height of 35,000ft. Compressed air for pressurization and air con-

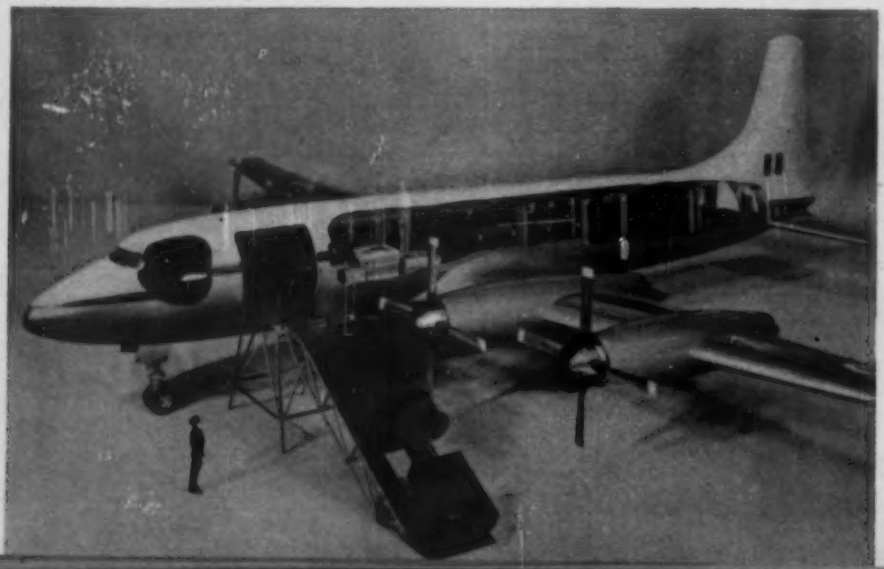
British Aircraft 1958

Bristol Britannia 320 (drawing below)

Powerplant	Four Bristol Proteus 765
Span	142ft 3½in
Length	124ft 3in
Gross weight	180,000 lb
Cruising speed	357 m.p.h.



Bristol Britannia 253 model.



ditioning is tapped from the compressors of each engine.

The electrical system is operated by four 50 kVA generators, one driven by each engine. These produce outputs of 208 V, 104 V and 65 V three-phase alternating currents. These are rectified to provide 112 V and 28 V direct current supplies. Alternating current at 115 V is provided by inverters.

The hydraulic system is operated at a normal working pressure of 3,500 lb/sq in to 4,000 lb/sq in; the four electrically driven pumps which supply power are switched off after take-off until just before landing.

The ice-protection system provides for ram-air heated by a hot-gas tapping from each engine for de-icing of the wing leading edges. The tailplane and fin are protected by electrical mats; engine ducts are protected by exhaust-heated ram air. The formation of ice in the critical bend of the reverse-flow Proteus air intake is now prevented by tappings from the compressor which energize the boundary layer in this area. The D.H. propellers—which will in future have solid light alloy blades with rounded tips instead of the square-tipped hollow-steel blades presently used—are electrically protected.

Sycamore Both civil and military versions of the Sycamore helicopter have been produced and over 150 have been completed. Some 70,000 flying hours have been accumulated. Powered by an Alvis Leonides engine giving 540 h.p., the Sycamore has a three-bladed main rotor and a cabin which can be arranged to seat five people. Military versions are equipped with all fixed fittings for immediate conversion to any of six rôles, namely, search and rescue, air ambulance, transport, freight transport, crane and dual instruction.

Sycamores have now seen service all over the world and have been delivered to the Royal Air Force, the British Army, Royal Australian Navy, Royal Australian Air Force, Royal Belgian Air Force, German Armed Services, British European Airways and Australian National Airways. The German order is for 50, 30 of which have already been delivered.

Bristol 192 The first Bristol 192 took the air on July 5, and the remainder of a batch for the R.A.F. will follow it. It is the largest military helicopter in Western Europe and has been ordered as a general-purpose machine capable of carrying either 6,000 lb of freight or up to 22 passengers. The lifting system consists of two four-bladed rotors, similar in design to those of the Sycamore, and driven by two Napier NGa.2 Gazelle free turbines. These engines, mounted immediately behind the cockpit and under the tail fin, drive directly to their respective rotor-heads. A synchronizing shaft connecting the two drives ensures that one engine can drive both rotors to maintain single-engined flight. Should power failure occur, the output of the other engine is automatically increased to take the full load. Normal power is 920 h.p., though 1,650 h.p. are available for 2½ min and 1,300 h.p. for one hour.

An accessory drive taken from the rear shaft operates a generator and two 9 kVA, 200 V, 400 c/s alternators to supply the required electrical power. The same shaft is used to drive a two-stage Plannair blower entraining air through the transmission oil cooler; and all these units are mounted atop the fuselage immediately ahead of the fin. The stack of pumps, driven from the intermediate gearbox at the rear end of the synchronizing shaft, circulates oil to the three main gearboxes. Total fuel load is 560 gal, of which 280 gal are contained in a tank immediately behind the front engine. The other 280 gal are divided between two tanks fore and aft of the rear engine. Although the fuel load is thus divided to serve each engine separately, full cross-feeding facilities are provided; and fixed portions of the fuel may be jettisoned if heavy loads are to be picked up.

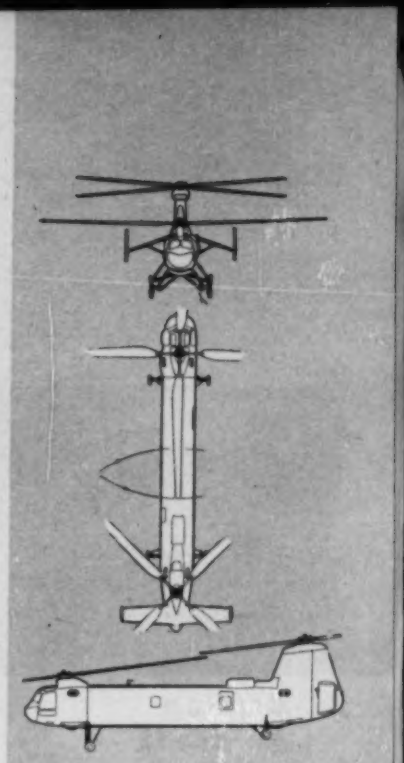
The cockpit of the 192 strongly resembles that of the Sycamore and is designed to accommodate a pilot to the right and a co-pilot or navigator to the left. By folding the back of the seat and opening a folding door, the co-pilot can crawl down a walkway in the port side of the fuselage and reach the main cabin through a further door. From this walkway he can also gain access to the front engine compartment and, similarly, the rear engine compartment can be reached through a communicating door at the end of the cabin. Electrical and radio equipment is stowed on racks at the rear of the cabin.

The main access doorway is to starboard, and the door may consist of a canvas screen, a light metal door or a strengthened door which can be locked in the open position and on which a hydraulic or electric hoist capable of lifting 600 lb may be mounted. Rescued persons or cargo may be raised by winch, or a scrambling net may be attached to the door sill to facilitate rapid entry or exit for troops. Stretchers or troop seats may be attached at strong-points in the floor, these points also serving for lashing cargo.

Entirely manual, the control system incorporates the standard Bristol spider mechanism for collective- and cyclic-pitch control. The rotors turn in opposite directions to counteract torque. An anhedral tailplane and end-plate fins ensure longitudinal and directional stability in cruising flight. The undercarriage of the 192 is unusual. The forward pair of legs, carrying fully castering landing wheels, is longer than the rear pair, but both units are mounted at equal distances from the c.g. At their inboard ends the legs are held by damper struts to allow a degree of rolling and to permit the 192 to land on sloping ground. Wheelbase is 30ft and track 10ft. Messier telescopic struts allow a normal touch-down velocity of 8ft/sec and an emergency velocity of 12ft/sec.

Each Gazelle is mounted within a titanium fireproof cowling through which cooling air is entrained by a fan and by the main engine intake. Engine air is, in fact, breathed through intakes beneath the fuselage and through the intakes immediately beneath each rotor head. Full fire-detection and suppression facilities are incorporated. Engine starting is by iso-propyl nitrate systems.

The 192 is equipped with a Louis Newmark autopilot providing short-term stabilization, stable cruising or hovering flight. A detailed description and cutaway drawing of the 192 appeared in *Flight* for August 1.



Bristol 192

Powerplant	Two Napier Gazelle NGa.2
Rotor diameter	40ft 8in
Fuselage length	54ft 4in
Gross weight	18,000 lb
Cruising speed ...	Up to 130 m.p.h.

Bristol 192.

Bristol Sycamore (Type 171 Mk 4).

British Aircraft 1958

The de Havilland Aircraft Co., Ltd.

Hatfield, Herts. Telephone: Hatfield 2345

de Havilland Comet 4 (photograph above)

Powerplant	Four Rolls-Royce Avon 524
Span	115ft
Length	111ft 6in
Gross weight	156,000 lb
Cruising speed	500 m.p.h.

de Havilland Comet 4B (drawing above)

Powerplant	Four Rolls-Royce Avon 524
Span	107ft 10in
Length	118ft
Gross weight	156,000 lb
Cruising speed	530 m.p.h.

Comet 4 Series There are three basic variants of the de Havilland Comet jet transport family: Comet 4, 4B and 4C. Present production, which is now well into its stride at the parent factory at Hatfield and at the second-source line at Chester (which is the main production factory for other D.H. aircraft), is concerned with the Comet 4. A fleet of 19 of this version is on order for B.O.A.C.; the first delivery is imminent as the 1958 S.B.A.C. Display opens, and the whole fleet should be in service by the end of next year. Deliveries of Comet 4s to the first export customer, Aerolineas Argentinas, will be made next spring. Six are on order for the Argentine carrier, for services to New York and to Europe.

The Comet 4B is made at Hatfield, six having been ordered by British European Airways for delivery due to begin towards the end of next year. This version is a greater-capacity, shorter-range, faster clipped-wing development intended particularly for regional jet services. It has been ordered by B.E.A. to fulfil their interim need to meet jet competition until delivery of 24 Airco D.H. 121s starting in 1964. The Comet 4C combines the increased payload capacity of the 4B with the wing of the Comet 4: it is intended for medium-to-long haul operations, and is in effect an improved cost-per-seat-mile development of the Comet 4. So far no firm orders have been placed for the Comet 4C.

According to present plans B.O.A.C. intend to introduce the Comet 4 into service later this autumn; probably by the time this issue of *Flight* appears a firm date will have been announced for the inauguration of a once-weekly B.O.A.C. Comet 4 *Monarch* service between London and New York. This service is being introduced under the competitive influence of Pan American's announced plans to put the Boeing 707-120 into North Atlantic service this autumn. Though this will mean that B.O.A.C.'s plans to introduce Comets on to the British Commonwealth routes may be delayed, there is no reason to doubt that the capabilities of the Comet 4 will stand the Corporation in good stead on the North Atlantic route pending delivery, at the end of 1959, of B.O.A.C.'s Boeing 707s.

The Comet 4 will enter service with a background of experience that will be unique. In addition to B.O.A.C.'s 30,000 hr of Comet 1 jet operating knowledge, and more than two years of regular operations by Royal Air Force Transport Command's fleet of ten Comet 2s, which has now flown about 14,000 hr, B.O.A.C. have been intensively operating two Comet 2Es on Avon Mk 524 engine-development and crew-training flights. The sum of this experience amounts to 3,500 hr, of which more than 400 have been flown on North Atlantic proving flights. The main objective of the Comet 2E programme was to clear the Comet 4's Rolls-Royce Avon Mk 524 for an overhaul life of 500 hr at the start of operations: in fact an overhaul life of 1,000 hr has already been approved for the engine.

Fuel tankage of the Comet 4 and 4C is 8,990 Imp. gal. This is reduced in the 4B (mainly by elimination of the two external 440 Imp. gal wing-nacelle tanks) to 7,890 Imp. gal. Capacity payload of the Comet 4 is 19,124 lb. This is increased to 22,454 in the Comet 4B, and to 23,209 lb in the Comet 4C. The structure of all variants is guaranteed for a fatigue life of 30,000 hr, having been designed to a structural programme aimed at evolving an anti-fatigue formula and demonstrating anti-fatigue properties by tests. All systems have been considerably improved as compared with early Comets, and in some cases considerable re-engineering has been involved. The elevator circuit of the powered flying controls incorporates feel in proportion to air speed; the cabin air supply is distributed and controlled to attain higher efficiency and ease of operation; and the electrical system is based upon the generally accepted fail-safe twin busbar distribution system.

A summary of the basic characteristics of each Comet 4 variant is as follows. Common to each is the Rolls-Royce powerplant of four Avon RA.29s (initially Mk 524) of 10,500 lb static thrust each.

Comet 4 This is a medium-capacity jet airliner capable of accommodating up to 81 passengers. It can operate on stages of up to 3,000 st. miles carrying, with full fuel reserves, a payload of 15,700 lb.

Comet 4B This is an increased-capacity variant (though it still falls into the medium-size category by comparison with the DC-8 and Boeing 707). It is intended for economical operation on stages as short as 400 to 500 miles; using a different (Comet 4) cruising technique, the 4B can operate stages of up to 2,500 st. miles. Maximum seating accommodation provides for 102 passengers.

Comet 4C Known as the "intermediate" Comet, this variant offers more payload than the 4 for the price of a small reduction in stage length. On a stage of 2,800 st. miles the 4C can carry full fuel reserves and a payload of 15,200 lb.

Sea Vixen Now in production for the Fleet Air Arm, the Sea Vixen will soon replace the Sea Venom as the standard carrier-borne all-weather fighter of that Service. Although based on the original DH.110 prototype, the Sea Vixen is a completely redesigned machine specifically adapted for its Naval rôle. Extensive use has been made of integrally stiffened skins; and many unstressed parts are made of plastic materials.

A particular feature of the Sea Vixen is that it is the first British Service fighter without gun armament. The only internal installation consists of two retractable rocket containers (made by Microcell) having tubes for 28 2in folding-fin, spin-stabilized, air-to-air rockets. In addition, there are three pylons under each wing and these are capable of carrying combinations of external tanks, bombs, rockets, or honeycomb rocket packs, the latter also made in plastics by Microcell. The standard intercepter armament would consists of four de Havilland Firestreak infra-red-homing missiles. It can be assumed that the Sea Vixen is capable of carrying a nuclear store for strike purposes, for which rôle the rocket and bomb stores are also intended. With generous internal tankage, supplemented by external tanks and flight refuelling, the Sea Vixen offers very considerable range or endurance for both strike and interception duties. The probe-and-drogue refuelling boom is to be mounted on the leading edge of the port wing, outboard of the intake.

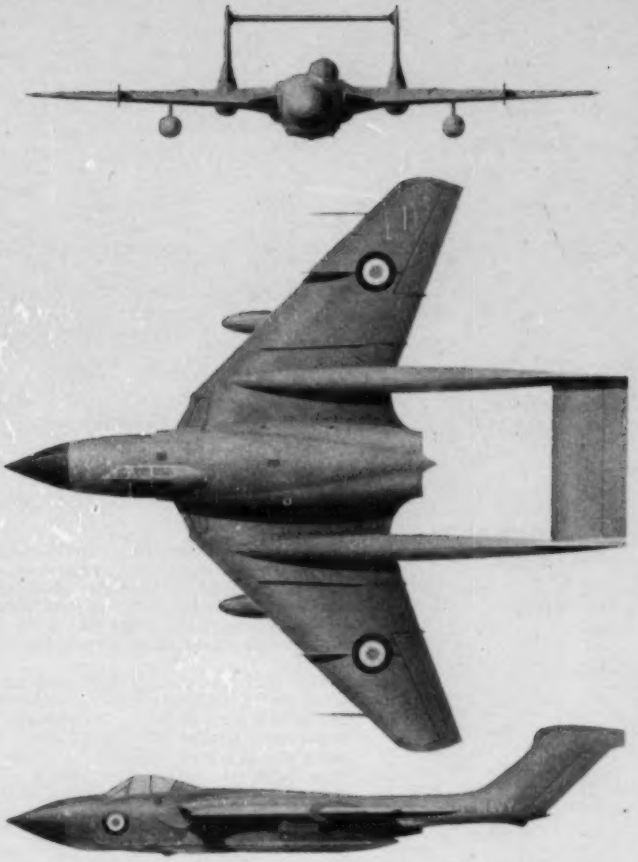
The Sea Vixen powerplant consists of two late-model Rolls-Royce Avons mounted side-by-side in the after portion of the centre fuselage, their effluxes passing underneath the high-set tailplane mounted on the twin-boom tail. As noted in a detailed description in *Flight* for April 5, 1957, the Sea Vixen has a fully powered control system supplied by four hydraulic pumps driven from a Rotol gearbox mounted between the two engines. Both port and starboard drive-shafts incorporate a freewheel, so that the failure of one engine will not affect the hydraulic supplies. In the unlikely event of the failure of both engines, a ram-air turbine can be extended from beneath the fuselage to maintain hydraulic power. There is no manual reversion. Artificial q-feel, by Hobson, is applied to the rudders, while spring-feel is provided for ailerons and tailplane. The latter surface normally operates as a single unit with an automatic gear change which approximately doubles surface-response to stick movement at transonic speeds. In addition, the lowering of the flaps automatically unlocks an elevator surface which moves up progressively to counter the trim-change caused by flap extension and also acts as a geared tab. At the same time the datum of the control column is shifted several inches forward so that the pilot can comfortably apply very considerable tail-down control deflections without risk of stalling the tailplane or fouling the column.

An autopilot is fitted to provide either auto-stabilizing or full flight-path control and, for the sake of simplicity, the ailerons are in this condition operated as elevons. The flaps extend rearwards and downwards to provide very considerably increased lift.

For carrier operation the wings and nose-cone of the Sea Vixen fold and a long-stroke undercarriage is fitted. In accordance with modern practice, the aircraft is rotated on the catapult into a fully tail-down attitude before launching. The pilot sits under a canopy offset to port, while his observer is within the fuselage to starboard. Both have Martin-Baker Mk 4 ejection seats. A sizeable order for Sea Vixens was placed in 1955. The basic development of the Sea Vixen was handled by the former Airspeed Division of de Havilland at Christchurch, and a number of FAW.1 aircraft have now been completed there. The bulk of the contract will be filled from Chester.

Vampire T.11 Now the standard advanced trainer in the R.A.F. and Fleet Air Arm, as well as with a score of foreign air forces throughout the world, the Vampire T.11 is still in production. Arranged to accommodate two pilots side-by-side in Martin-Baker Mk 3 ejection seats, the T.11 has two/four 20 mm guns and can carry tanks, rockets or bombs under the wings. The engine is a de Havilland Goblin.

A single blind-flying instrument panel is mounted centrally in the cockpit; and two gyro gun-sights are provided, so that both flying and armament training can be given. Most of the equipment requiring between-flights servicing is concentrated in the nose compartment under a large hinged fairing. The canopy of all recent T.11s is of the single-piece, clear-view type.

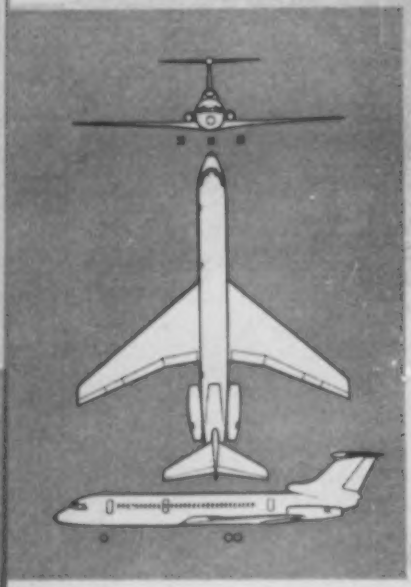


de Havilland Sea Vixen FAW.1 (drawing above and photograph below)

Powerplant	Two late-model Rolls-Royce Avon
Span	50ft
Length	53ft 6¼in

British Aircraft 1958

Airco D.H.121 (artist's impression above and provisional drawing left)
Powerplant Three Rolls-Royce RB.141
Dimensions and weights not revealed.
Cruising speed approximately 600 m.p.h.



Airco D.H.121 The parent company of the British aircraft industry consortium which is building the D.H.121 is the de Havilland Company; their share in Airco (Aircraft Manufacturing Company) is the major one, while Hunting Aircraft and Fairey Aviation hold the remaining interests.

The D.H.121 is a high-subsonic jet airliner which sprang expressly from the requirements of British European Airways. It completes the pattern of trunk-route jet airliners which are now being developed to cover traffic needs ranging from 3,000 to 4,000 miles (DC-8 and 707), through 1,000 to 3,000 miles (Convair 880 and 600 and Boeing 720). The D.H.121 is designed for economical operations up to about 1,000 miles; thus its definition as a short-range jet airliner.

Design of the D.H.121 has now progressed sufficiently for a contract to have been placed by B.E.A. Valued at £29m, it calls for the delivery of 24 aircraft in the period 1964 to 1966. (B.E.A.'s interim jet requirements—1960 to 1963—will be met by a fleet of six Comet 4Bs.)

The most unusual feature of the D.H.121 is the triple-turbojet powerplant; these are Rolls-Royce RB.141s (Conway derivative) by-pass turbojets of 12,000 lb static thrust each. Three engines were chosen to keep weight and cost (particularly maintenance and overhaul) to a minimum while achieving the required engine-out performance. The method of installation—a rear-mounted arrangement—was adopted because of the significant advantages of a clean wing and cabin quietness.

Maximum seating capacity will be of the order of 100, though B.E.A.'s standard layout will probably be for 70 to 80 passengers. So far as the British Corporation is concerned, the D.H.121 will be used for the longer-haul sectors of its network, turboprop Vanguards being assigned to the short-stage operations. The Corporation's requirement is for a 6,000ft take-off field-length performance, though obviously ability to use longer take-off distances will considerably increase payload-range performance for medium-stage operations.

Cruising speed of the D.H.121 is likely to be of the 600 m.p.h. order.

The B.E.A. requirement called for an aircraft that would maintain the Corporation's competitive position right throughout the forthcoming high-subsonic jet era; it is reasonable to expect that the formula will find an application among other operators of regional networks in the sixties and seventies. The D.H.-Rolls-Royce-B.E.A. partnership which will back the Comet 4B is likely to continue, in the D.H.121, for perhaps two decades hence.

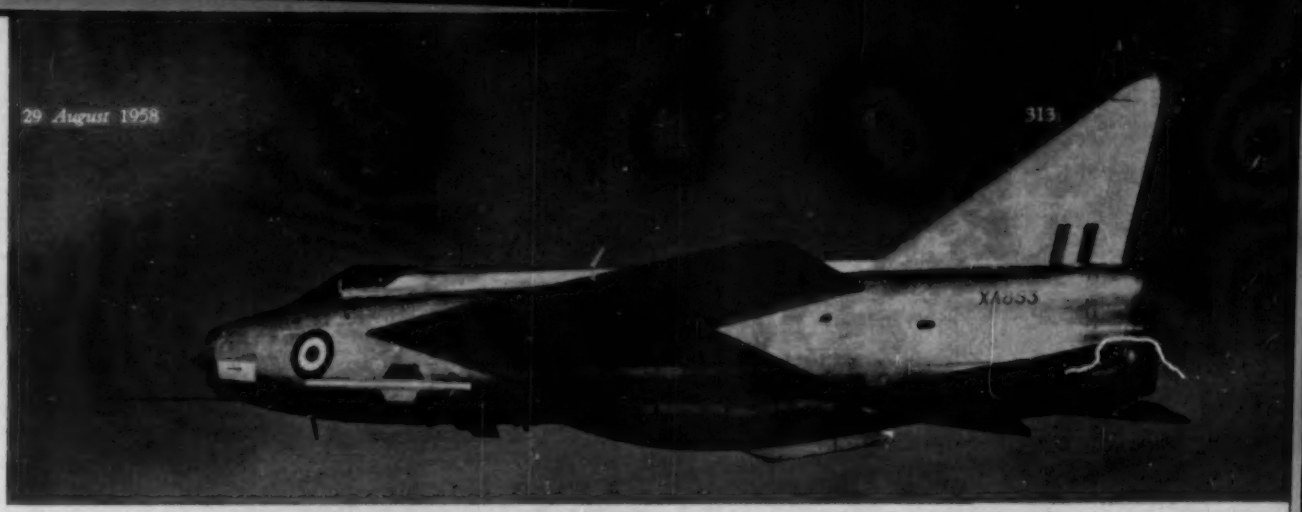
de Havilland Heron 2.

de Havilland Dove 5.

Dove 5 and 6 In terms of longevity of production, the Dove must rank as the most successful post-war British commercial aircraft. First purchased in 1946, a total of exactly 500 have now been delivered. Production is nowadays almost entirely to meet a sustained demand from executive and business operators.

Heron 2 To date 130 Herons have been delivered. The aircraft is still in a unique class: no other commercial aircraft of its size offers the four-engine safety which is normally the prerogative of trunk-route operations. The Heron is essentially an economical means of pioneering and sustaining inherently costly but necessary "social" services and feeder routes. In addition, however, it has penetrated quite deeply into that most particular of commercial markets—the business and "corporate" owner, who like the scaled-down big airliner qualities of the aircraft.

Chipmunk 23 This is the latest version of the Canadian-designed elementary trainer, intended specifically for agricultural spraying and top-dressing work. It has been developed jointly by de Havilland and Fison-Airwork; main difference from the standard two-seat Chipmunk is the re-location of the pilot's seat aft, and the fitting of a large (14 cu ft) tank-hopper in the forward compartment.



The English Electric Co., Ltd.

Marconi House, Strand, London, W.C.2. Telephone: Covent Garden 1234

English Electric P1.B Lightning
(photograph above and drawing below)

Powerplant
Two advanced Rolls-Royce Avon
Span 34ft 10in
Length 50ft

P.1B Lightning The next, and possibly the last, intercepter for the R.A.F., the P.1B will be able to exceed Mach 2 and has already flown at well over 1,200 m.p.h. Three prototypes and a pre-production batch of 20 as well as a sizeable production run have been ordered; and about half-a-dozen machines are now flying. They are powered by a pair of late-model afterburning Rolls-Royce Avons, mounted one above the other in the fuselage, the lower engine being somewhat ahead of the upper. A circular nose-intake admits air to both engines round a centre bullet which (it has recently been announced) is designed to accommodate the Ferranti Airpass fire control radar. This equipment will automatically compute and control an attack for the pilot.

An exclusive *Flight* cut-away drawing of the P.1B which appeared on January 10 clearly illustrated the structure of the 60-deg swept wing with its five spars and integral tankage disposed all round the main undercarriage bays. Further fuel can be carried in a large ventral fairing; and this can also be arranged to accommodate a Napier Double Scorpion rocket motor providing exceptional acceleration and high-altitude capability. The major portion of the wing trailing-edge is taken up by split flaps, while the ailerons are mounted across the square-cut wing-tips. The similarly swept slab-tailplane is actuated by Hobson twin screwjacks mounted beneath the lower jet-pipe. The airbrakes are now located high in the fuselage flanks, ahead of the fin; and a braking ribbon-parachute is streamed from a case beneath the tailpipes.

Armament consists of two de Havilland Firestreaks mounted on pylons on the flanks of the fuselage, their operating equipment being carried in what appears to be a removable pack occupying the under-fuselage at this point. This unit can probably be exchanged for a gun-carrying pack; and two further Aden 30 mm guns are permanently mounted with their barrels lying either side of the cockpit. There are also two 24-tube launchers for 2in rockets.

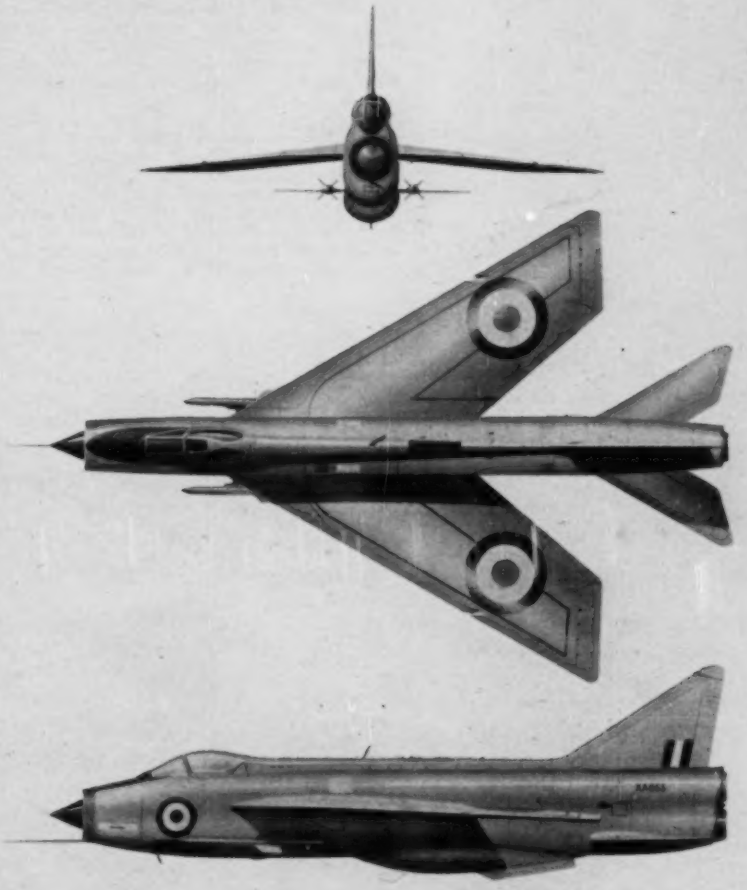
The whole wing is built in halves, which are then joined to pass through the fuselage between the engines. Special assembly methods are employed to minimize work inside the wing after upper and lower skins have been assembled with their supporting structure, and rubber blocks have been used to seal the structure to contain fuel. The inboard portion of the wing leading-edge has a slight permanent droop, but it also appears to be capable of drooping further for the approach. Chordwise slots in the leading edges form aerodynamic fences. One of the P.1A prototypes has appeared with a new wing having a kinked leading-edge providing increased chord and some camber over the outboard section. It has not been stated whether this will become a feature of production Lightnings.

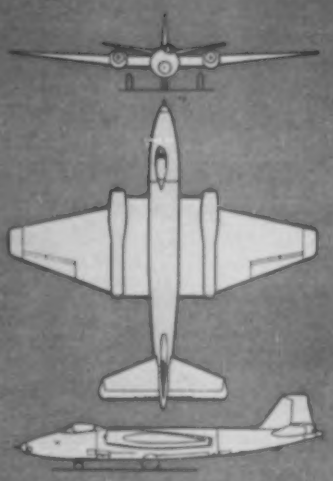
The single-seat cockpit is, of course, fully pressurized and incorporates a clam-shell canopy, hydraulically actuated. A Martin-Baker ejection seat is fitted. British Messier designed the distinctive undercarriage, the nosewheel of which is steerable and retracts forwards to lie in the "6 o'clock" strut of the intake centrebody. The main units retract outwards and rearwards into the wings, the cover doors being hinged at the inboard sides of the wells.

P.11 It was announced recently that a two-seat version of the P.1B is to be produced for the R.A.F. as pilot-trainer. The cockpit would be widened to allow side-by-side seating, and few other changes would be made.

Canberra B(I).8 Sixth of the nine Canberra variants to enter service, the B(I).8 is designed as an interdicter for low-level night attacks. The first Canberra production variant, the B.2 is still in service in considerable numbers with the R.A.F., having for many years formed the backbone of the bomber force. B.6 and B(I).6 bomber versions followed, with more powerful Avon engines and the interdicter capability.

The B(I).8 has a completely redesigned for-



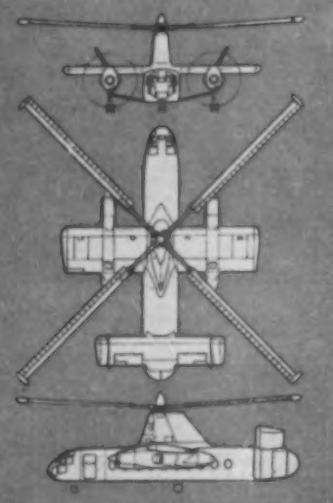


English Electric Canberra PR.9 (drawing and photograph above)

Powerplant	Two Rolls-Royce Avon
Span	66ft
Length	66ft 8in

Fairey Rotodyne prototype (drawing and photograph below)

Powerplant	Two Napier Eland NEL3
Rotor diameter	90ft
Fuselage length	58ft 6in
Gross weight	33,000 lb
Cruising speed	170 m.p.h.



ward section incorporating accommodation for the pilot under a fighter-type blown canopy offset to port and for the navigator in a seat, facing port, further forward. Previously the pilot sat to port under a circular blown canopy and his two navigators sat side-by-side behind him.

All Canberras are fitted to carry jettisonable 244 Imp. gal fuel tanks at the wing-tips and the B(I).8 has fuel fillers in the wings as well as in the fuselage. Normal visual bombing is carried out from a position in the nose, though intruder versions are known to be fitted for LABS.

The weapon bay can accommodate six 1,000 lb bombs on triple clusters designed by A. V. Roe. These can also hold six 800 lb clusters of incendiaries or eighteen 100 lb practice bombs. The bay is large enough to accommodate nuclear weapons of kiloton yield. The intruder can also carry a 1,000 lb bomb on a pylon under each wing; and a removable pack of four 20 mm guns with a very considerable ammunition load, designed by Boulton Paul, fits in the bomb-bay.

Canberra B.2s have been built under licence in Australia as the B.20 and in America, in various versions, as the B-57 and RB-57. Venezuela ordered B.2s, B.8s and T.4s; France and Ecuador bought B.6s and Peru B.8s; India bought 68 B.8s, PR.7s and T.4s; Venezuela reordered and New Zealand bought B.8s and T.4s. Over 750 of all types were built in Britain by English Electric, Shorts, Avro and Handley Page. A description and cut-away drawing of the Canberra appeared in *Flight* for March 14.

Canberra PR.9 The first of a sizeable batch of PR.9s ordered from Shorts made its first flight in July. It is powered by late-mark Avons and has a considerably redesigned wing and a B.8-type canopy. Both span and chord of the wing are greatly increased and the ailerons are powered.

Canberra U.10 First information on the Canberra U.10 pilotless drone was released in May. The type is converted from the B.2 by Short Brothers and Harland, Ltd., and carries a fully automatic flight-control system.

Canberra T.11 Announced earlier this month as a four-seat A.I. trainer for Fighter Command, the T.11 was converted from the B.2 by Boulton Paul.

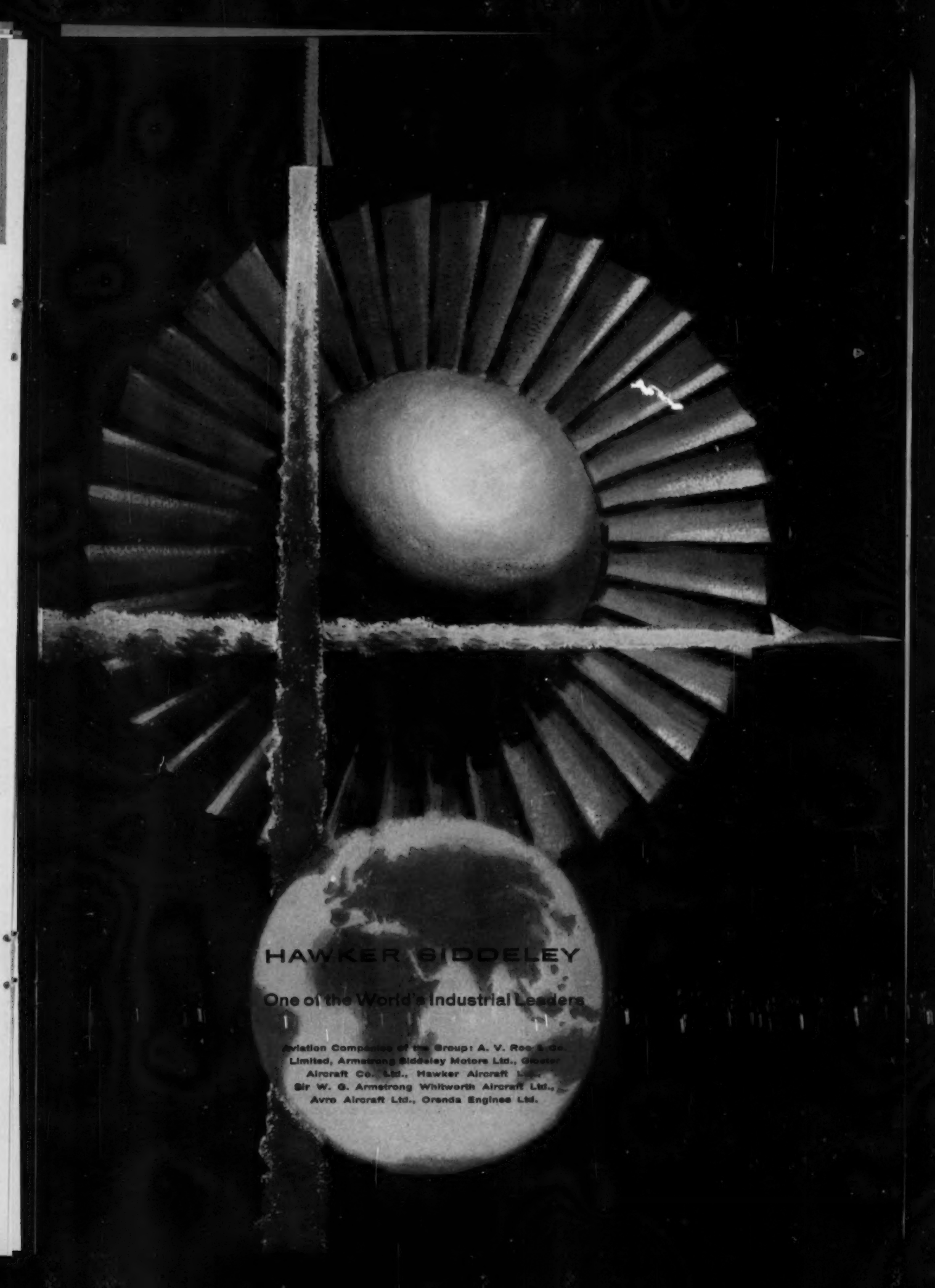
The Fairey Aviation Co., Ltd.

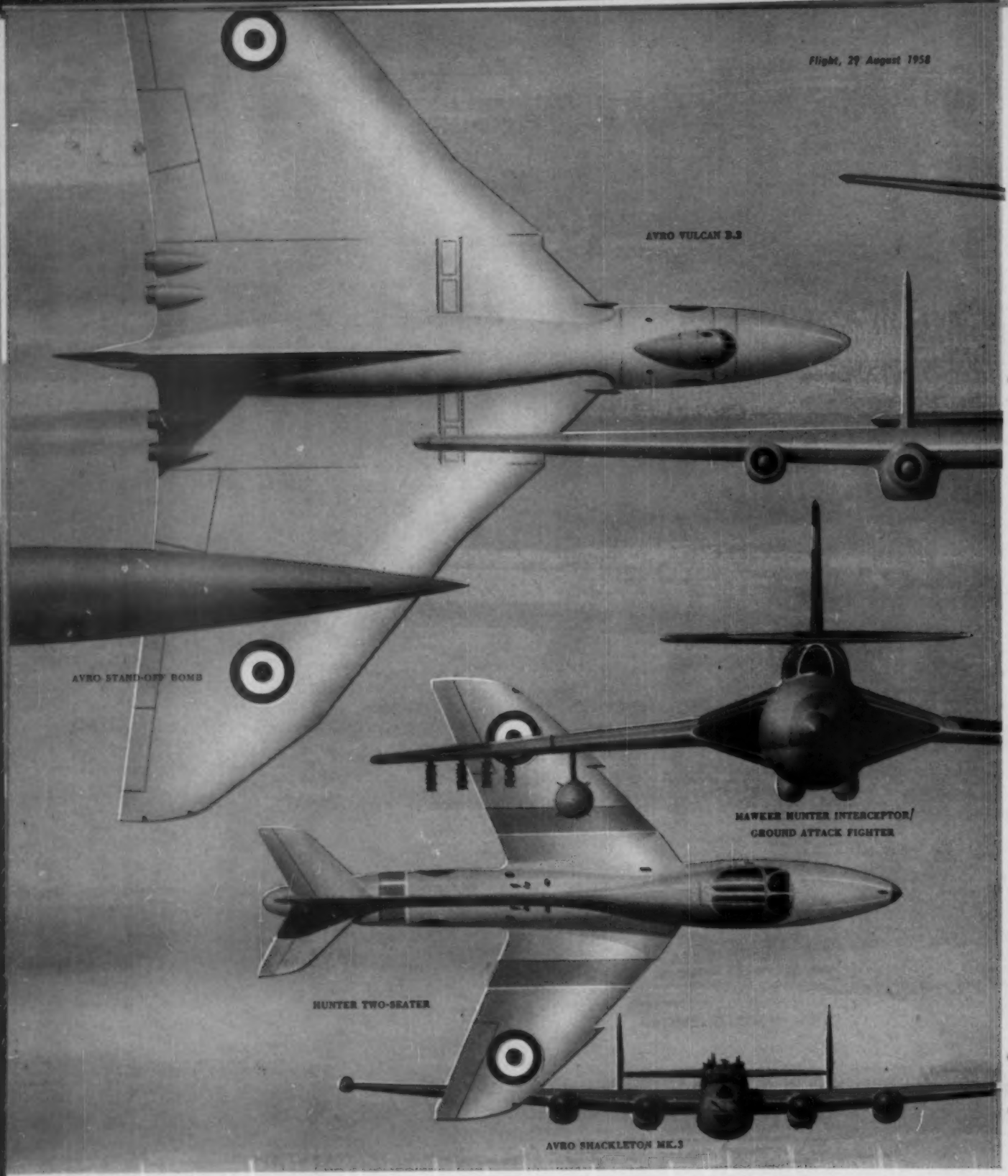
Hayes, Middlesex. Telephone: Hayes 3800

Rotodyne The world's first true VTOL airliner, the Rotodyne is a unique engineering achievement which promises to revolutionize inter-city air transport operations. Simply stated, the Rotodyne combines vertical take-off and landing and hovering capabilities with the forward speed of a DC-3 and seating for 48 passengers.

The prototype, which has been on test since last December, has a single lifting rotor, a fixed wing, and two Napier Eland turboprops driving conventional propellers. The powerplant is engineered to feed compressed fresh air to the main rotor for vertical flight; most of the Eland's power is absorbed at take off by the rotor, the tip of each of which is fitted with a kerosine-burning pressure jet. Transition to forward flight is achieved by progressively transferring power from the rotor to the propellers. In this condition the Rotodyne cruises solely on the thrust of the propellers, lift being provided by the autorotating rotor and the conventional wing, the last-named component providing about 60 per cent of the lift during the cruise.

Commercial application of an airliner of the Rotodyne's promised capabilities and economy is obviously extensive. It will permit air transport to penetrate into the centres of cities, and to operate self-supporting services to other communities at fares which are competitive with those offered by surface carriers. So far the handicap of inter-city or airport-to-city helicopter services has been the very high cost of operating present machines; the Rotodyne is expected to remove

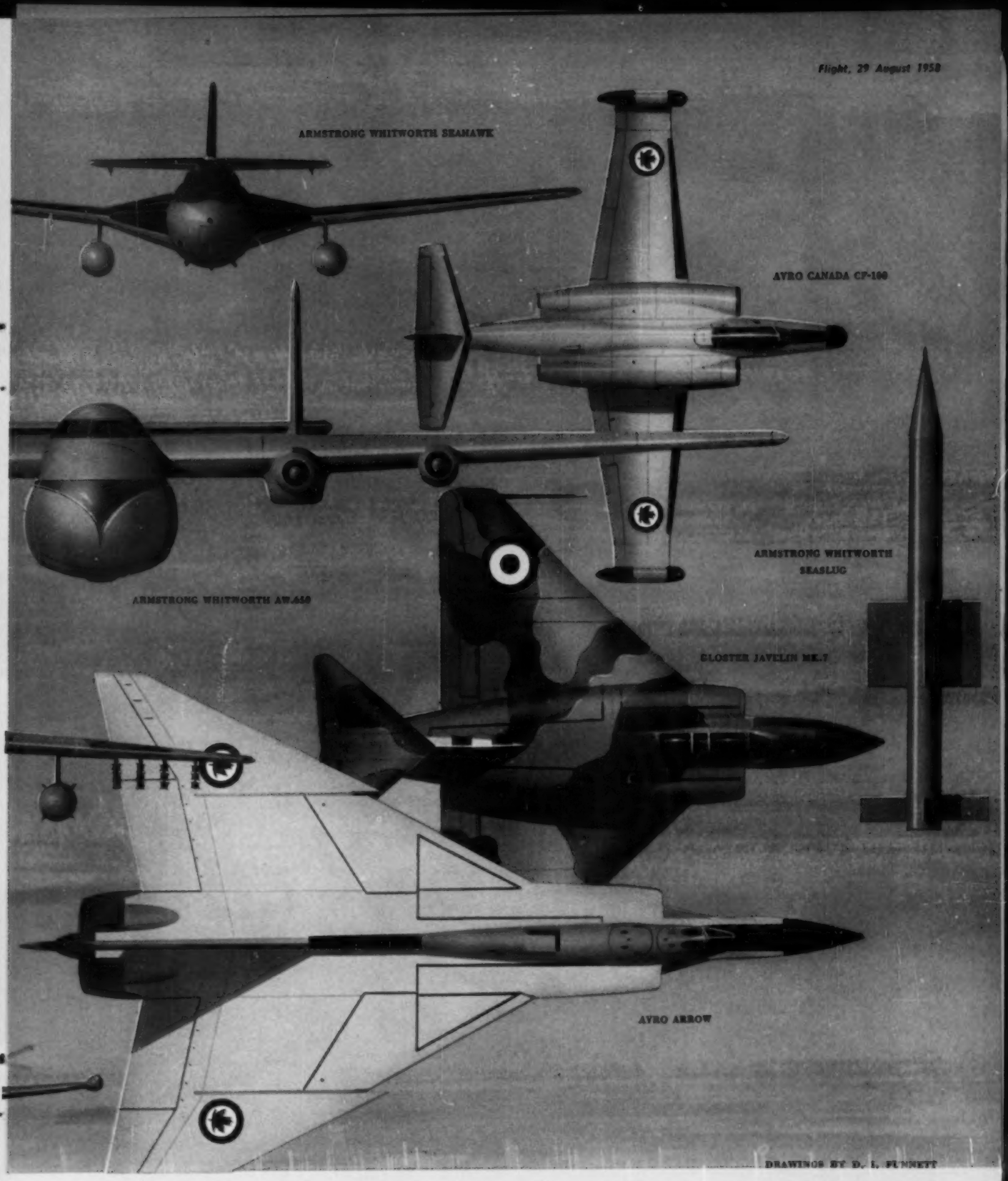

HAWKER SIDDELEY
One of the World's Industrial Leaders
Aviation Companies of the Group: A. V. Roe & Co. Limited, Armstrong Siddeley Motors Ltd., Gloster Aircraft Co. Ltd., Hawker Aircraft Ltd., Sir W. G. Armstrong Whitworth Aircraft Ltd., Avro Aircraft Ltd., Orenda Engines Ltd.



HAWKER SIDDELEY IN THE AIR

Proof of Hawker Siddeley's leadership in the aircraft industry is afforded by this composite picture of the aircraft manufactured by member companies. It strikingly illustrates the Group's achievements in the fields of defence, maritime security, jet training, civil air transport, and guided missiles.

The Avro Vulcan, the R.A.F.'s front-line V-bomber, has been described as "the most effective bomber at present in service". A. V. Roe is also developing the stand-off bomb, which will be fitted to V-bombers and give extra flexibility in attack. The Shackleton, also designed and built by A. V. Roe, is in service with R.A.F. Coastal Command and with the South African Air Force. The Shackleton is the deadliest submarine-killer in existence.



The Hawker Hunter has astonishing manoeuvrability and carries the heaviest fixed armament of any ground-attack fighter in the world. Hunters are in service with the air forces of Britain, Sweden, Denmark, Holland, India, Iraq, Belgium, Peru and Switzerland. The two-seater version is in service with the R.A.F. and Royal Navy as an operational trainer, and with the air forces of India, the Netherlands and Denmark.

In the centre of the picture is Hawker Siddeley's contribution to peacetime aviation—the Armstrong Whitworth AW.650, the world's first pressurised turboprop freightercoach, due to fly before the end of the year.

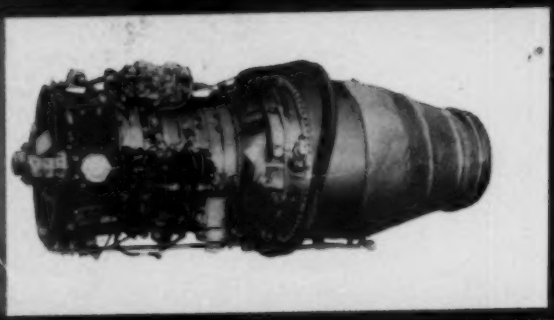
Another AWA product, the Sea Hawk, is a formidable Naval interceptor. Sea Hawks are in service with the naval air arms of Britain and Holland, and have been ordered by the Republic of Western Germany. AWA have also produced the Seaslug, the first ship-to-air guided missile developed in Britain. The Gloster Javelin Mark 7, latest version of the R.A.F.'s all-weather fighter, can carry rocket projectiles and a Firestreak guided missile under each wing, as well as two cannon. From Canada, comes the Avro Aircraft CF-100, a long-range, all-weather fighter in service with the R.C.A.F. and the Belgian Air Force. The Avro Arrow, the delta-wing fighter, has now made its first flights and proved itself capable of operating at speeds over 1,000 miles an hour.

ASM
DOUBLE
MAMBA

The Double Mamba powers the Fairey Gannet. Half the engine may be shut off for cruising, thus saving fuel and increasing the Gannet's range.

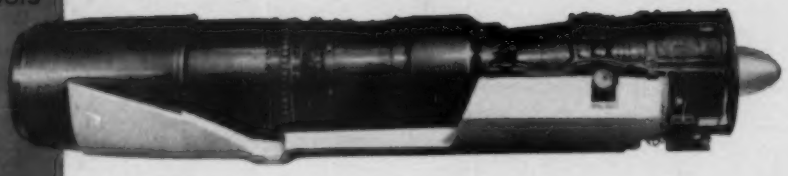
ASM VIPER

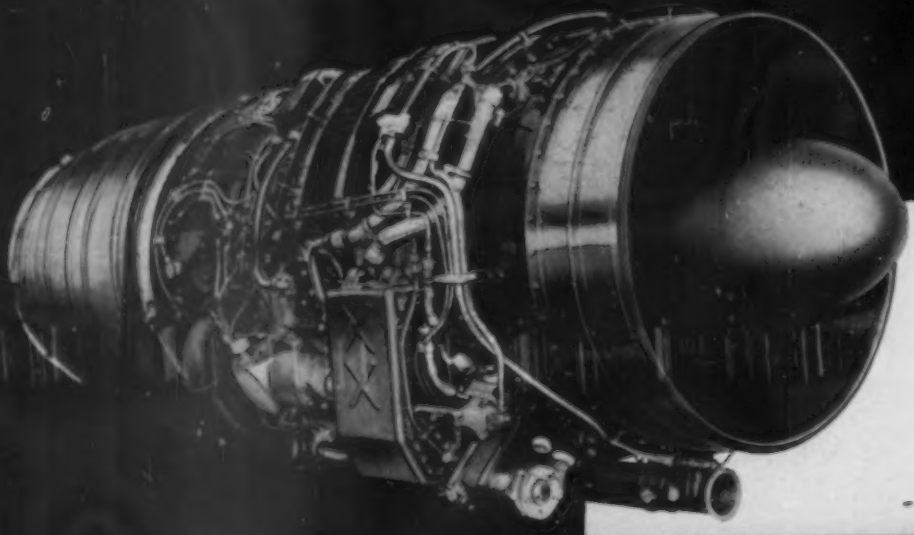
The Viper powers the world's first all-through jet trainer — the Hunting Provost. The Viper is robust, easily serviced, and has a really high utilisation rate.



AVRO CANADA IROQUOIS

The Iroquois is built by Orenda Engines Ltd., the engine company of the A.V. Roe Canada Group. The Iroquois develops over 20,000 lbs. thrust and will power Canada's supersonic Avro Arrow.



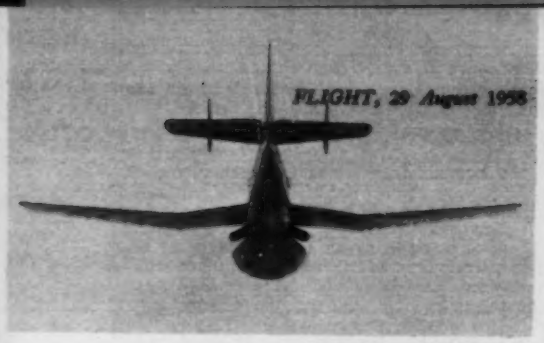


ASM SAPPHIRE

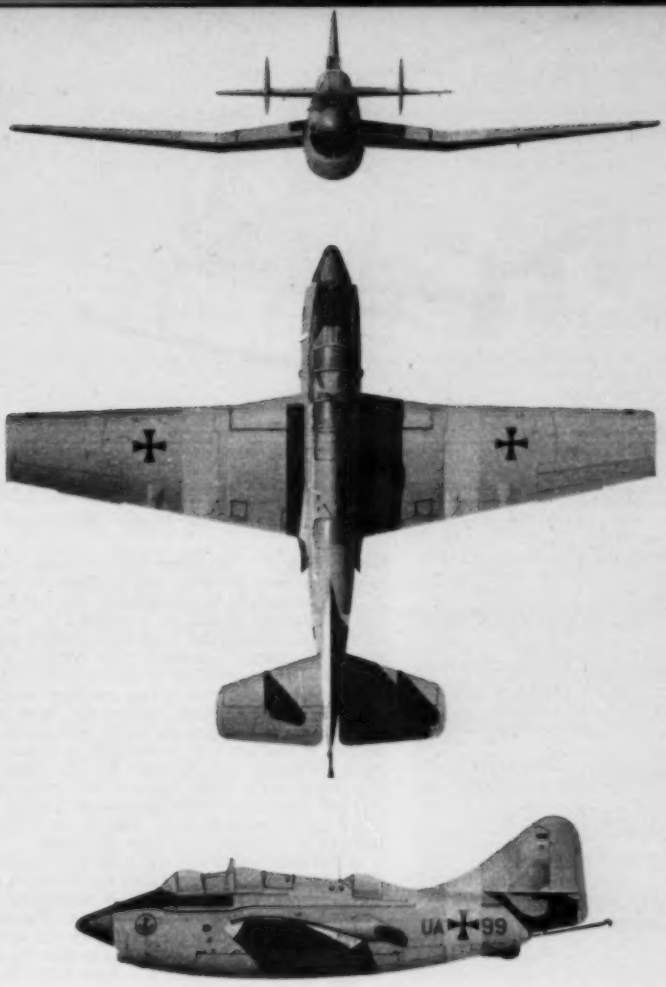
The Sapphire powers fourteen of the world's leading military aircraft, including the Victor bomber, the Javelin all-weather fighter and some versions of the Hawker Hunter. The Sapphire is playing a vital role in safeguarding the free world.

HAWKER SIDDELEY

One of the World's Industrial Leaders



Fairey Gannet AEW.3 model.



this handicap, and of course to provide the twin-engine security essential for commercial operations over urban areas. The Rotodyne offers also to bring air transport to island communities.

The name of British European Airways has been associated with the Rotodyne; the Corporation states that the aircraft may well provide the economic vehicle which it is seeking to develop scheduled helicopter-type services.

F.D.2 Designed and constructed by Fairey Aviation to meet a Ministry of Supply requirement for a supersonic research machine, the F.D.2 was outstandingly successful. It was soon appreciated that it would be capable of speeds much higher than those envisaged when it was first planned, and by 1956 it was regularly flying at 1,000 m.p.h. On March 10 the first of the two F.D.2s, flown by Peter Twiss, Fairey's chief fixed-wing test pilot, established a world record for absolute speed of 1,822 km/hr (1,132 m.p.h.), which stood for eighteen months. The F.D.2 was fully described in our issue of April 25 last; powerplant is a Rolls-Royce Avon with afterburner.

Gannet AS.4 Now the standard fixed-wing anti-submarine aircraft of the Royal Navy, the Gannet AS.4 differs from the AS.1 mainly in having a more powerful Armstrong Siddeley Double Mamba engine and in equipment. The crew of three are accommodated in three cockpits, arranged to afford full 360-deg visual coverage (a large number of submarine sightings are still made visually). A capacious weapon bay can accommodate two homing torpedoes or bombs, mines, depth charges, sonobuoys and other stores; and the search radar is mounted in a retractable container immediately aft of the weapon bay. Further stores, including sixteen 60 lb R.P.s, may be carried on underwing racks. The aircraft is fitted for catapulting and deck landing; and the engines are specially arranged for ease of handling and immediate acceleration in case an overshoot is required. The two Mambas, each driving one of the contra-rotating propellers, are independent of each other and either may be shut down for normal cruising flight. Stopping or starting takes only a matter of seconds.

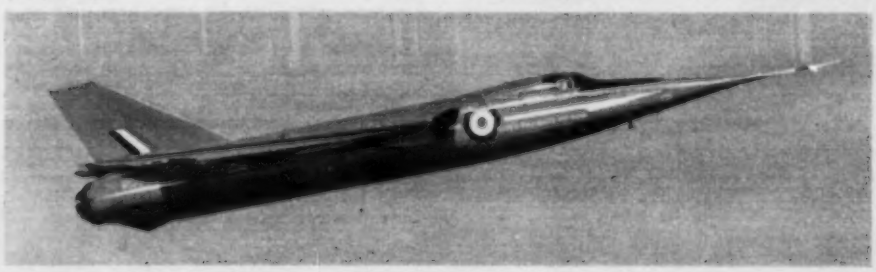
In addition to serving with the Fleet Air Arm, Gannets have been bought by the Royal Australian Navy and the German naval air arm.

Gannet T.5 Bearing the same relationship to the T.2 as the AS.4 bears to the AS.1, the T.5 is a pilot trainer for Gannet handling and weapon-delivery. It therefore retains the weapon bay, but has no search radar. The instructor, sitting in the centre cockpit, has full flying controls and a simple periscope to augment his field of vision directly forward. An observer, or two passengers, may be carried in the rear cockpit. Full carrier-landing facilities are retained and, as with all Gannets, the wings fold at two points.

C. M. Lambert, of *Flight* staff, flew the prototype Gannet T.5 for an hour from White Waltham last year (see issue of December 6, 1957). He reported that "the machine can be flown at weights approaching that of a loaded Dakota yet is very light to handle and without any aerodynamic peculiarities. At first acquaintance the controls of the two turboprop engines seem very complicated, but in practice engine handling is perfectly straightforward. Above all, the approach and touch-down are remarkably simple."

Gannet AEW.3 Intended specifically as an early-warning picket aircraft, this variant of the Gannet is extensively modified to accommodate a powerful search radar scanner in a ventral fairing. Crew accommodation and internal layout have been completely revised and a more powerful Double Mamba is fitted. The tail surfaces, too, have been changed. The first of a batch of AEW.3s ordered for the Fleet Air Arm is now completed. In service, the type will replace the AD-4W Skyraiders, which have now been doing radar-picket work for a number of years.

Fairey F.D.2.

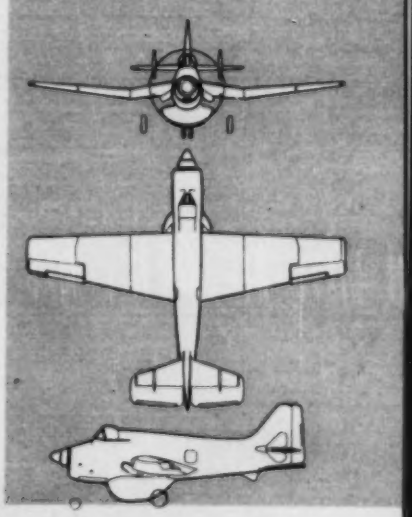


Fairey Gannet T.5 (drawing above)
Powerplant
Armstrong Siddeley Double Mamba

Span	54ft 4in
Length	43ft

Fairey Gannet AEW.3 (drawing below)
Powerplant
Armstrong Siddeley Double Mamba

Span	54ft 4in
Length (without sting)	44ft



Fairey Ultra-Light.

Ultra-Light A number of these small two-seat helicopters have now been completed and considerable flight-testing has been carried out. Trials have shown the feasibility of landing the Ultra-Light on a frigate at sea.

The powerplant is a Blackburn Palouste air generator supplying air to the tips of the rotor blades where it is further burnt with fuel and discharged through nozzles. A very high rate of climb is possible; and precipitate descents have been practised for certain military applications. An Ultra-Light has now flown in Naval colours, indicating the possibility of an order from this source. Flying controls of the Ultra-Light are fully powered by Fairey Hydroboosters; and the observer may sit facing forwards or rearwards.

Folland Aircraft, Ltd.

Sydney Lodge, Hamble, Hants. Telephone: Hamble 3191

Folland Gnat Trainer

Powerplant	Bristol Orpheus BOr.4		
Span	...	...	24ft
Length	...	...	30ft 9in

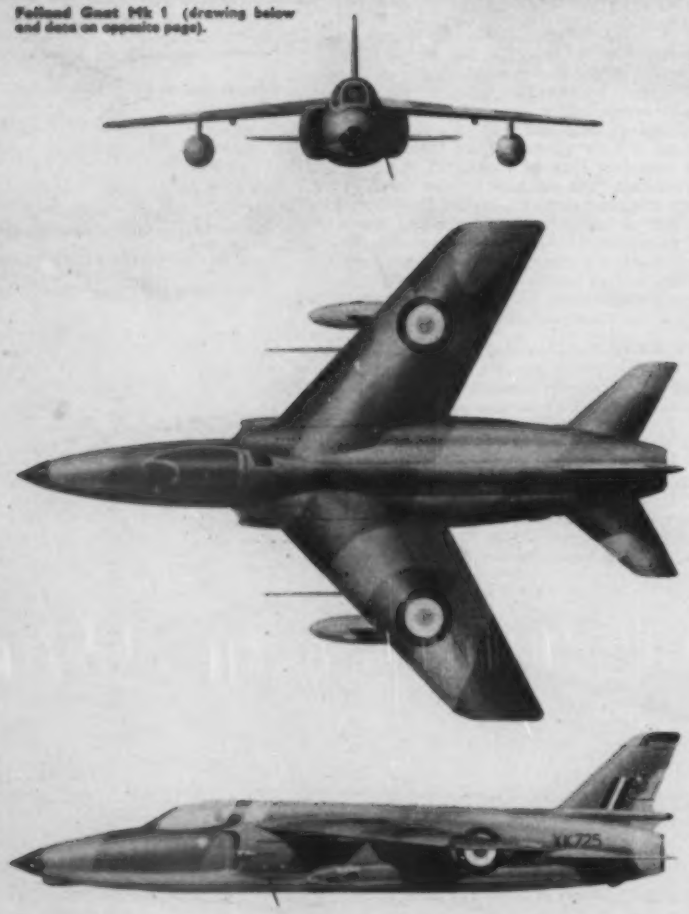
Gnat Mk 1 No fewer than 59 Gnat Mk 1s have now been ordered; and of these at least a dozen have already been delivered. The full flight-test programme should be completed by the end of the year and tropical trials have already shown that performance estimates were correct. Only 21 days were required for 45 flights and the tropical take-off distance was in fact less than expected. Two Gnats, with their equipment, have been shipped by rail to Jugoslavia for evaluation and several of the batch of 25 ordered by India have been delivered. Components for 15 Gnats are also being sent to India, together with many of the jigs and tools with which Hindustan Aircraft will build Gnats under licence. Two of the 12 Gnats ordered by Finland have been delivered.

A full description and cut-away drawing of the Gnat Mk 1 published in *Flight* for November 22, 1957, illustrated the ingenious structural and systems arrangement of the machine. Though in no sense expendable, everything in the aircraft has been simplified and lightened so that the gross weight of the intercepter is a mere 6,250 lb. Its Bristol Orpheus 701 engine delivers 4,850 lb thrust, affording spectacular acceleration, climb and speed capability. Area rule for transonic flight has been applied and Mach 1 can be exceeded in a shallow dive. The wing has an R.A.E. aerofoil and a thickness ratio of 8 per cent. Inboard ailerons are actuated by Lockheed jacks in the fuselage, their datum being arranged to change following a cable linkage with the undercarriage. The latter can be partially extended to allow the fairing doors to act as air-brakes; and full extension causes the ailerons to droop 20 deg to act as flaps. By the same adjustment, aileron travel is increased.

The tailplane is all-moving and powered by a Hobson twin-screw-jack unit, feel springs being incorporated in the linkage. Horizontal control is therefore by a slab surface, but in emergency the elevator may be mechanically unlocked for manual operation and the tailplane used for trimming. Manual reversion is also provided for the ailerons. There are only six hydraulic actuators in the whole aircraft. The fuel system, holding 174 Imp. gal in seven bag tanks in the fuselage, is automatic in operation; and two 66-gal tanks may be carried on pylons. The cockpit is pressurized and air-conditioned and has light armour protection. It is equipped with a Folland Type 1 automatic ejection seat with leg restraints and firing interconnected with hood jettisoning. Communications radio, I.F.F., radar ranging, A.D.F. and telebriefing are standard.

For tactical work the Gnat can carry two 500 lb bombs and two 66-gal tanks; or two 500 lb bombs and six 3in rockets; or eighteen 3in rockets; or twelve 3in rockets and two drop tanks; or a camera pod carrying three F.95 cameras and a drop tank; or several other combinations of stores. Gross weight then varies between 7,550 lb and 8,600 lb. Two 30 mm Aden guns and 240 rounds of ammunition are standard.

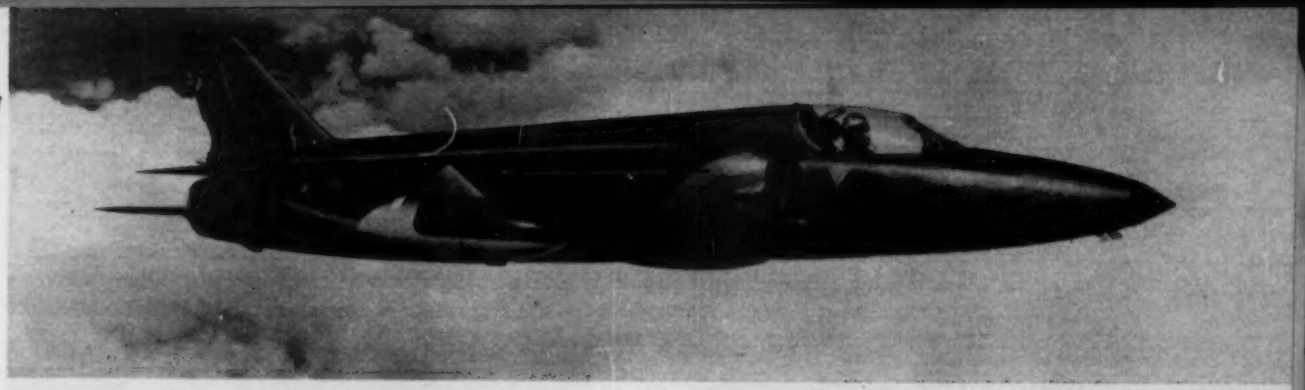
Folland Gnat Mk 1 (drawing below and data on opposite page).



Gnat Mk 2 Development of the fully supersonic Gnat Mk 2 is well under way and a prototype should fly next year. It will have a more powerful Bristol Orpheus with simplified reheat; and extensive high-lift devices are being incorporated in order to allow operation both from small land bases and carriers. Flap-blowing may be included, together with outboard ailerons. Thickness/chord ratio will be 6 per cent. Fire-control radar and guided missiles will be carried.

Gnat Trainer Work on the Gnat Trainer has been proceeding for some time, first as a private venture, then with M.o.S. support and, since March this year, with an order for a development batch of 14, the first of which should fly next year.

The Trainer will have a 7-per-cent wing of increased span fitted with split flaps and outboard ailerons. Other features include a larger tail, Flight Data System instruments, liquid oxygen, internal fuel capacity of 260 Imp. gal (part of which replaces the two 30 mm guns of the fighter) and a derated Orpheus BOr.4.



Gloster Aircraft Co., Ltd.

Gloucester, Glos. Telephone: Gloucester 67011

Javelin No fewer than six marks of the Javelin two-seat all-weather fighter are now in service with the R.A.F.; and they form the backbone of this country's intercepter force. Powered by two Armstrong Siddeley Sapphire engines mounted either side of the fuselage, the Javelin accommodates pilot and navigator in tandem and has a powerful search radar in the nose. The delta wing has a kinked leading edge, powered outboard ailerons with blunt trailing edges and conventional split flaps. Airbrake surfaces extend above and below the wing. The swept fin carries a delta horizontal tail which, on the Mk 1, consists of a powered elevator and electrically variable tailplane. The armament of the Mk 1 consists of four 30 mm Aden guns mounted in the wings, ammunition links being retained and the cases jettisoned. FAW.1s went into service in 1956.

The FAW.1 was followed into service by the FAW.2, whose main innovation is an all-flying tail.

A two-seat trainer version has been ordered for the R.A.F. and bears the designation T.3. The development machine was modified by Air Service Training, Ltd., from an FAW.4 and has increased internal fuel capacity, Sapphire 6 engines and an all-flying tail. The front fuselage has been completely rearranged to accommodate pupil and instructor in tandem, the instructor's ejection seat being considerably raised to provide forward view. In addition, the instructor is provided with a binocular periscope having viewing lenses mounted on streamlined pylons projecting on either side of his cockpit. The extensive search radar has been replaced by a simple radar-ranging unit. Overall fuselage length has been increased by nearly 4ft.

The FAW.4 is basically similar to the FAW.1, but has an all-flying tail and, probably, a rather more advanced radar. Its armament is still four Aden guns mounted in the wings. It has been noted that FAW.4s bear pitot intakes mounted on top of the rear fuselage; and these presumably supply airspeed signals to the horizontal-tail feel system. The top contour of the extreme rear fuselage is also raised slightly to improve the aerodynamic characteristics of the tail; and Javelins of this vintage carry the familiar "pen-nib" tail fairing. A radar altimeter and vortex generators also became standard in the FAW.4.

The FAW.5, which has also gone into service, is again basically similar to the Mk 1 but has increased fuel capacity and an all-flying tail.

The FAW.6 is a development of the FAW.2 but has increased fuel tankage, probably disposed in the same way as that in the FAW.5.

Probably the most important advance in the Javelin series is the FAW.7, which is equipped with the much more powerful Sapphire 7 engines and can carry four de Havilland Firestreak missiles on underwing pylons. The number of Aden guns is reduced to two; the battle camera is moved into one of the disused gun positions; flag-type stall-warning indicators are mounted at approximately mid span and 20 per cent chord; and the number of pressure intakes serving the feel system has been doubled. To accommodate the larger engines the tail was lengthened and is once more squared off; and it seems likely that a developed radar is fitted. The engine intakes are noticeably larger.

The FAW.8 is the first Javelin to have reheat for its Sapphire engines. With this additional power the performance, and particularly the climb, are very greatly improved, although even the FAW.4 had a performance strictly comparable with that of the Hunter. The FAW.8 also carries four Firestreaks and two guns; and an aircraft of this series has been shown fitted with Microcell 37-tube honeycomb launchers for 2in spin stabilized rockets.

All marks of Javelin are equipped to carry two ventral tanks (side-by-side) each of 250 Imp. gal.

Folland Gnat Mk 1 (photograph above)

Powerplant	Bristol Orpheus 701
Span	22ft 2in
Length	29ft 9in
Gross weight	Up to 8,600 lb
Maximum level speed	Mach 0.98

Gloster Javelin FAW.8 (drawing below)

Powerplant	Two Armstrong Siddeley Sapphire
Span	52ft
Length	56ft 4in

Gloster Javelin T.3 (foreground) and FAW.4.

Handley Page, Ltd.

Claremont Road, Cricklewood, London N.W.2. Telephone: Gladstone 8000

Handley Page Victor B.1 (photograph above and drawing below)

Powerplant	Four Armstrong Siddeley Sapphire
Span	110ft
Length	114ft 11in

Victor B.1 The first squadron of Victor B.1s has now been formed in No. 3 Group, Bomber Command. Powered by four Armstrong Siddeley Sapphire turbojets and characterized by its distinctive crescent wing, the Victor carries a crew of five in the nose and a large bombing and navigation radar in a bulge beneath the forward fuselage. High-lift flaps and drooping leading edges, together with a high-set tailplane, have conferred on the Victor particularly docile landing characteristics. The eight-wheel bogies of the main undercarriage units retract rearwards to lie within the wing, and large airbrake surfaces are mounted at the rear of the fuselage. It has been stated that the capacious bomb bay of the Victor will be able to accommodate a stand-off bomb. Either conventional H.E. bombs or nuclear weapons will initially be carried.

During 1957 a Victor very probably exceeded Mach 1 by a margin of about 15 m.p.h. at about 40,000ft during a routine test flight. The Machmeter was calibrated after the flight and found to have been accurate, and a loud boom was heard over southern Hertfordshire. It is reasonable to suppose that all the control surfaces are fully powered and that artificial feel is provided. In common with the other V-bombers the Victor probably also carries Doppler radar for navigation; and a visual bombing position is located in the nose. A very large ribbon parachute can be streamed from the tail to provide deceleration during the landing run. The crew of five will include two pilots in automatic ejection seats and two navigators and an air electronics officer sitting side-by-side in rearward-facing seats.

The structure incorporates spot-welded sandwich panels giving a very smooth external surface. A distinctive recognition feature of the aircraft is the many-faceted windscreen arrangement formed by a series of flat laminated glass panels electrically heated for demisting purposes. Additional transparencies behind the windscreen follow the curvature of the fuselage. A wide pitot-type intake in the extreme nose probably serves to supply an indication of total pressure to the artificial feel system of the powered controls. Two large intakes either side of the nose, just aft of the visual aiming windows, serve the cabin air-conditioning system. In early Victors these intakes were of the flush NACA type, but one aircraft has been seen with a prominent scoop over each of these intakes. Early Victors had drooped leading edges divided into two sections, the inboard of which drooped to a greater angle than the outboard. In production machines there is a single drooping surface. Similarly a small dorsal fillet was incorporated in the fin structure of the early machines and this has now been replaced by a constant chord fin arrangement. Large strakes along the edges of the airbrakes serve to restore the effective surface area lost by the curvature of the airbrake panels.

Victor B.2 Victor B.1s will be followed into service by the more advanced Victor B.2, which may have greater span and other aerodynamic refinements, and is known to be fitted with the much more powerful Rolls-Royce Conway RCo.11 by-pass turbojets. Each of these will deliver a thrust of 17,250 lb—and possibly more in later machines. From figures published for the H.P.111, it seems likely that the latter type is developed from the Victor B.2. The powerplants of the two types are the same and Handley Page state that the H.P.111 will have a wing span of 130ft and a gross weight of 240,000 lb. It seems apparent, therefore, that the B.2 has a wing span 20ft greater than that of the B.1. The Victor B.2 will certainly be capable of delivering the stand-off bomb. One might also expect it to incorporate a degree of area-ruling.

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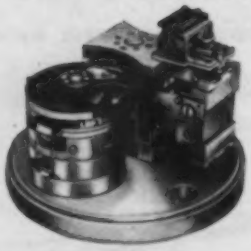

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Dart Herald Handley Page, as an entirely private venture, decided in 1953 to enter a contestant for the elusive DC-3 replacement market. The result of a detailed market investigation was the four-piston-engined Herald which first flew in August, 1955. A second prototype flew about 12 months later. At first, interest in the aircraft was encouragingly strong, and Handley Page received options for about 35 aircraft from several operators. Subsequently, however, the market became more and more predisposed toward turbine power—in particular to the Rolls-Royce Dart which established an extremely high reputation right from the early days of Viscount operations. Handley Page responded to this changed requirement by offering, in May, 1957, a twin-Dart version of the Herald. The Alvis piston-engined prototype, which was well ahead with its trials and airworthiness tests, was withdrawn from the test-programme for the necessary modifications to be made. Right on the original published schedule, the new turboprop Herald made its debut in March of this year, and immediately began a flight mum range with full payload (700 st. miles compared with 265).

The new Dart Herald is a considerable improvement on its predecessor, which it now supersedes, in respect of speed (275 m.p.h. at 15,000ft as compared with 210 m.p.h.) and maximum range with full payload (700 st. miles compared with 265).

Powerplant is the latest and most powerful version of the Rolls-Royce Dart to enter service—the RDa.7/2 Mk 527 of 2,100 e.h.p., the engine of the Viscount 810, with which there is a considerable amount of powerplant interchangeability. In one important respect, however, does the powerplant differ. To permit full use of the Dart's power to be made for take-off, large-diameter 12ft 6in Rotol propellers will be fitted. These are the largest units yet fitted to the Dart and compare with the 10ft (trapezoidal-planform) propellers of the Viscount 810.

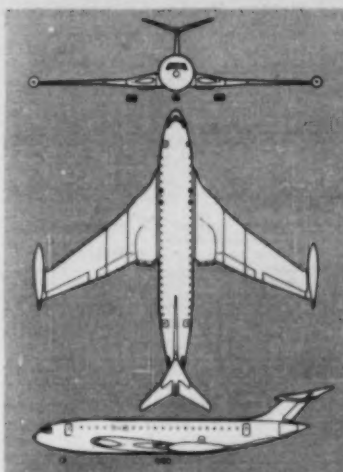
Standard seating arrangement of the Dart Herald is 36 seats in nine rows of two double chairs at 38in pitch. A maximum of 47 seats can be accommodated. Capacity payload is 10,160 lb, and maximum fuel tankage is 1,080 Imp. gal. Balanced take-off field length is 3,700ft.

The market for the Dart Herald is potentially a very large one, not only because of the large number of DC-3s, C-46s and similar types which must eventually be replaced, but also because the Dart Herald is a class of aircraft which is not likely to be outmoded for many years by "something better." The local-service and feederline operators of the world are not so strongly influenced by new technological developments as are the highly competitive trunk carriers. As Sir Frederick Handley Page said when the Herald was first announced: "You don't have to go through the sound barrier when you are competing with an ox-cart." This remains as true today as it did in 1955, and it might not be optimistic to suggest that the Herald is likely to be a marketable product for a decade or more hence.

H.P.111 Development of the Victor bomber into a transport has been an obvious possibility even since the design was completed seven years ago. Over the years Handley Page have put forward several design studies to the Government and to B.O.A.C., originally concentrating on the airline market. Most recently, during the controversy about the future equipment of R.A.F. Transport Command, the "Treble One" was announced by the company as having been submitted to the R.A.F. for study.

The project retains, it may be supposed, the wing, powerplant (four Rolls-Royce Conway bypass turbojets, initially of 17,250 lb static thrust each) and tail of the Victor B.2 bomber. It is estimated that the aircraft will carry its full load of 202 men, or nearly 27 long tons of freight, for 3,800 miles, cruising at 545 m.p.h. Still-air range is 5,750 miles. Take-off distance to 50ft at 240,000 lb is 7,000ft, with water injection.

The Treble One could be in operational service by the end of 1962, say Handley Page, who are continuing to sponsor its development. Points of interest include the six-wheel (twelve-tyre) bogies, the circular section of the fuselage, and the very large rear door used for ramp loading and heavy dropping.



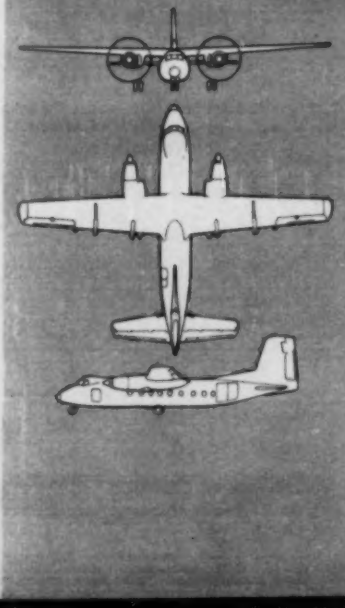
Handley Page H.P.111 (drawing and artist's impression above)

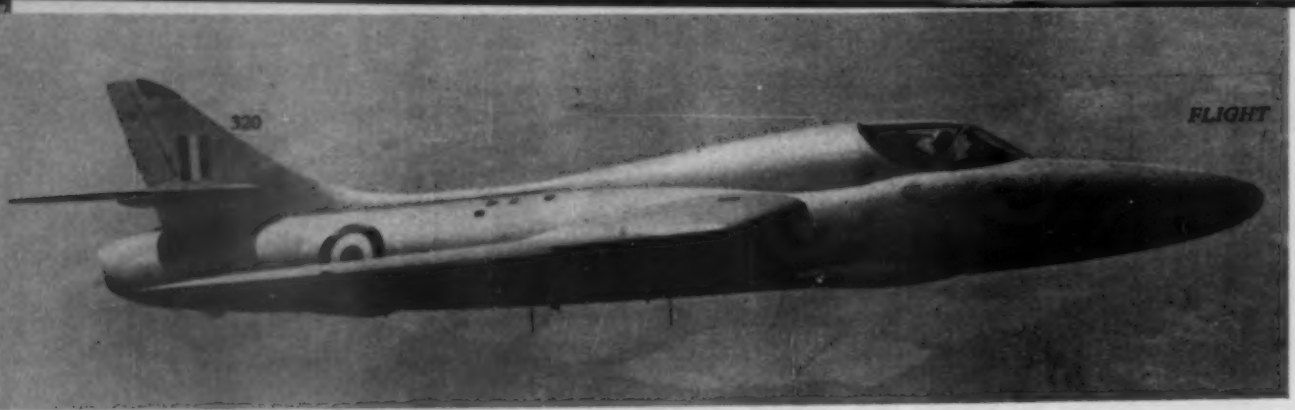
Powerplant	Four Rolls-Royce Conway
Span	130ft
Length	137ft 9in
Gross weight	240,000 lb
Cruising speed	545 m.p.h.

Handley Page Dart Herald (drawing and photograph below)

Powerplant	Two Rolls-Royce Dart 527
Span	94ft 9¼in
Length	71ft 11in
Gross weight	37,000 lb
Cruising speed	277 m.p.h.

H.P. Laminar Flow Projects For many years Handley Page have been making practical investigations into the reduction of drag by means of boundary-layer control. In the course of extensive flight-testing with a modified Vampire a system of suction slots has been evolved, and studies of two ambitious jet-transport projects have been proposed, each based on four Rolls-Royce Conways. One could carry a 30,000-lb payload over a stage distance, with full fuel reserves, of 5,300 st. miles cruising at 595 m.p.h. The other project, with a larger-span wing, and weighing 300,000 lb, could carry the same load over a distance of more than 10,000 st. miles at 560 m.p.h.





British Aircraft 1958

Hawker Hunter F.7 (photograph above)
Powerplant ... Rolls-Royce Avon
Span 33ft 8in
Length 46ft 10½in

Hawker Hunter F.4 (drawing and photograph below)
Powerplant ... Rolls-Royce Avon
Span 33ft 8in
Length 46ft 10½in

Hawker Aircraft, Ltd.

Canbury Park Road, Kingston-on-Thames, Surrey. *Telephone: Kingston 1044*

Hunter F.6 Acknowledged, after intensive competitive evaluation, particularly in Switzerland, as the best ground-attack fighter now available, the Hunter is in service with the R.A.F. and many foreign air forces. Over 1,000 Hunters of all marks except trainers have been built since the type was ordered "off the drawing board" in 1951. Considerable American "off-shore" orders have also been placed; and both Dutch and Belgian groups of companies have built Hunters under licence. The type is now in service with the British, Swedish, Danish, Dutch, Belgian, Peruvian, Indian, Iraqi and Swiss air forces. Swedish, Swiss and Indian orders each totalled well over 100 machines. In Britain, Hunters were built by Hawkers at Kingston and Blackpool and by Armstrong Whitworth at Coventry. Production is assured for at least two years to come. Hunter F.6s have an Avon 200-series engine, and earlier versions with Avon 100-series and Sapphires are in service.

Described in *Flight* for May 9 last, the structure is a conventional system of frames, ribs and stringers covered with constant thickness skins and very few large forgings. The engine is housed in the centre fuselage and the complete tail can be detached for engine removal. Fuel tankage is located both in the fuselage and the wings; and either 100 Imp. gal or 230 gal drop tanks can be carried on the four underwing pylons. Elevator and ailerons are fully powered, with spring feel; and manual reversion is provided as a stand-by. Movement of the elevator contacts microswitches which cause tailplane follow-up under power from an electric motor. Trimming signals are also supplied to the follow-up system. The whole unit is remarkably effective and comfortable to use. A yaw stabilizer may be placed in the rudder circuit.

Fixed armament of all operational Hunters consists of a quickly removable pack of four Aden 30 mm guns. The gun-sight has radar ranging. A very wide variety of external loads can be carried including bombs of many nationalities weighing up to 1,000 lb; Oerlikon, Bofors or Hispano R.P.s on their respective launchers; 3in R.P.s of all kinds; 100 gal napalm tanks; honeycomb packs of 37 2in R.P.s; or clusters of two 25 lb practice bombs. Combinations of these stores can be arranged on the four pylons; or the rockets may be attached in tiers under four rails outboard of each inner pylon.

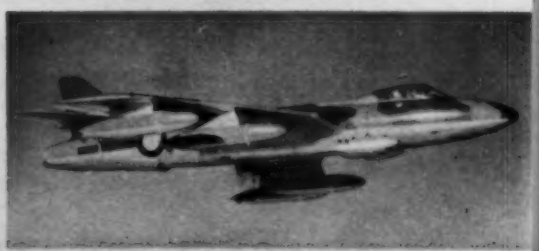
Hunter T.7 A side-by-side two-seat trainer based on the F.4, this variant has been ordered by the R.A.F. and, as the Mk 53, by the Danish air force. Deliveries are also being made to the Dutch air force. The T.7 has "saw-tooth" leading-edge extensions, a braking parachute and a single Aden gun housed in a fairing under the starboard side of the nose. Radar-ranging is carried. The engine is a Rolls-Royce Avon 100 series; and the pilots sit in Martin-Baker Mk 4 ejection seats.

A more powerful trainer based on the F.6, with an Avon 200 series engine, has been ordered as the Mk 66 by the Indian air force. The prototype was flown by C. M. Lambert of *Flight*'s staff (issue of May 17, 1957). He reported a time to 47,000ft of under seven minutes, a sea-level speed of over 600 kt and a touch-down speed of 110 kt. Fully powered elevator and follow-up tailplane gave precise and sensitive control at transonic speeds and engine handling was remarkably good.

Hunter T.8 The Fleet Air Arm is now receiving a slightly modified version of the T.7 under the designation noted here. The main innovation of the T.8 is the fitting of an arrester hook designed to pick up runway arrester wires.

P.1121 Both official and unofficial mention has been made of this new Hawker strike aircraft; and construction is known to be under way though there is now no official support for the project. Capable of high supersonic speed at low level, the P.1121 is to be powered by a de Havilland Gyron engine which, with reheat, has run at a thrust of 29,000 lb.

(*Review continued on p. 326*)



Industry in Transition

Latest information suggests that the British Aircraft Industry is successfully adapting itself to changed conditions

IT is now three months since the House of Commons debated the future of the aircraft industry. No one following that debate could possibly have been other than discomfited by the evidence and opinions circulated in the House. The Minister of Supply, Mr. Aubrey Jones, stated gloomily: "We wish to save the industry."

Despite the prospect of increased civil outlets for the aircraft manufacturers, based for the most part on the near certainty of continued expansion in the world of air transport, the impending reductions in defence expenditure appeared from the Commons discussion to demand a cut in the industry's total employment from the present level of slightly over a quarter of a million employees down to something of the order of 150,000 by the early sixties. An expected contraction in the number of major individual companies to four airframe manufacturers and two or three aero-engine manufacturers also appeared as a basic feature of Government policy.

As the Ministry of Supply does not encourage publication of statistics regarding the size of British companies—measured in terms, say, of employment, plant size or annual sales—the exact significance of this contraction in the number of firms can hardly be discussed, for nobody can say firstly how either "major" or "firm" are defined, and secondly which manufacturers fall into this category (Britain is alone among the major Western aircraft manufacturing countries in suppressing basic data on company size).

But despite these forbidding prognostications the outward signs provide little evidence yet of the industry finding itself in rough waters. Indeed, one of the basic pointers towards the condition of the industry—export statistics—tells a tale of remarkable achievement. Six months ago *Flight* boldly forecast that "it will be surprising if the 1957 level of exports can be maintained over the next few years." But the recently published export returns covering the first half of this year show that the value of British aviation goods sold abroad was 46 per cent greater than in the corresponding period last year.

Table 1 shows quite clearly the direction of this increase—the Commonwealth market. Total foreign exports (i.e., non-Commonwealth) are running at about the same level as last year, higher exports to the U.S. being more or less balanced by reductions elsewhere. But the exports to the Commonwealth in the first half of this year (£26m) are already greater than in the whole of last year (£23m). Whether or not the present cheering trends continue will depend on the level of exports in the rest of this year to the Dominions, particularly Canada and India. Now that T.C.A. have their Viscounts and C.P.A.L. have their Britannias, it is reasonably certain that exports to Canada will fall. Indian prospects are confused: civil deliveries will dwindle, but military exports of Canberras, Hunters and Gnats might even show a slight increase. Civil exports to the U.S. at present mostly consist of Viscount deliveries; these should continue at about the recent rate, with Continental receiving the last of their V.812a and Northeast accepting nine V.745Ds. To bolster the second half-year's results the Swiss order for 100 Hawker Hunters is now being delivered steadily, and its export value this year might well approach £5m (exports to Switzerland last year were valued at only £100,000). Even if the rate of growth does fall off during the months ahead, the fact remains that export prospects are brighter now than appeared to be the case at the beginning of the year. In brief, if the industry is ailing, then one must look beyond export statistics.

The perfect answer would be to produce industrial revenue statistics. In the case of America figures are readily available showing both current sales and backlogs for individual manufacturers and for the entire industry. No such details are available for this country. Relying on unofficial estimates it appears that the value of sales (at home and abroad, military and civil) for the British aircraft industry as a whole rose from £200m in 1951 to £400m in 1955 and 1956, but last year declined to about £380m.

In the face of such inadequate information as this, probably the most accurate picture of the industry's progress is provided by monthly employment statistics. And this picture, while showing a steady fall in the size of the British aircraft industry, is not as depressing as might be expected. Turning to the figures released by the Ministry of Labour, it is seen that the industry reached its post-war peak employment (266,000) in December 1956 and January 1957. Since then the total has fallen by an average of about 1,000 employees a month, reaching 250,000 at the end of last June. But the rate of fall has been accelerating: during the whole of 1957 employment fell by 8,000, but in the first half of this year it decreased by a like amount. By a strange coincidence the present rate of fall (about 16,000 per year) is exactly that which will reduce the industry in the early sixties to the size envisaged by the Minister of Supply.

Another labour statistic indicates this contraction: throughout last year unemployment in the aircraft industry stood at just under 1,500, but this year the figure has increased to around 2,000 (at which level unemployment appears to be currently stabilized). These figures suggest either that the redundancy problem is being solved by attrition rather than by dismissal, or that those leaving the industry are having little difficulty in finding alternative outlets for their talent.

There remains another aspect of the aircraft industry's reorganization to consider: what is happening about the "rationalization" that was discussed in such lengthy and vague terms last spring? Both in the fields of airframe and aero-engine manufacture there has been in the last six months a significant development. To construct B.E.A.'s 24 D.H.121s (an order valued at £29m) a consortium (Airco) was formed between de Havilland, Fairey and Hunting. Those impatient for a more extreme form of merger will say that this is no more than a blind to hoodwink the Govern-

Table 1: Export of aircraft and parts to countries, 1955-1958

	Annual value (£ x million) 1955	1956	1957	Value (£ x mill.) Jan.-June, 1958
Commonwealth:—				
Australia	2.3	11.8	2.9	1.7
Canada	5.3	4.3	3.9	9.4
India	1.2	1.2	11.0	10.9
New Zealand	0.9	1.3	0.9	0.8
Pakistan	1.7	0.5	0.2	0.2
Rhodesia	1.1	1.9	0.2	0.1
South Africa	1.1	0.2	0.4	0.9
Others	2.3	1.4	3.1	1.6
United States:—	2.0	17.2	5.1	4.5
Europe:—				
Belgium	2.1	2.9	1.4	0.4
France	2.6	3.1	3.1	1.1
Netherlands	2.6	2.4	4.0	1.3
Norway	0.1	0.2	0.9	0.4
Sweden	1.8	7.8	5.6	0.4
West Germany ...	0.1	0.1	1.9	2.9
Middle East:—				
Egypt	2.0	1.3	—	—
Iraq	1.6	0.4	0.9	1.7
Israel	0.4	0.2	3.0	0.4
Lebanon	1.0	0.4	2.5	0.8
Elsewhere:—				
Brazil	0.1	—	0.6	0.2
Burma	0.5	0.1	1.1	0.7
Total Commonwealth ...	15.8	19.4	22.6	25.6
Total Foreign	23.8	53.4	47.2	24.6
Total all countries ...	39.6	71.8	69.8	50.2

Table 2: Value of U.K. aero exports and imports, 1953-1958 (£ x million)

	1953	1954	1955	1956	1957	1958*
Exports:—						
Aircraft and parts ...	42.3	31.4	39.7	71.8	69.8	30.2
Engines	28.3	28.9	22.3	28.0	40.6	24.2
Electrical equipment ...	1.9	2.1	2.3	2.7	3.3	1.6
Instruments	1.2	1.3	1.4	1.4	2.0	0.9
Tyres	0.4	0.6	0.6	0.7	0.8	0.3
Total exports	66.1	56.2	66.3	104.6	116.5	77.2
Imports:—						
Aircraft	41.5	15.6	13.6	12.7	11.8	4.0
Engines	6.9	6.4	7.7	10.6	13.2	8.4
Electrical equipment ...	0.3	0.8	1.9	1.3	1.5	N.A.
Tyres	—	0.1	0.1	0.1	0.1	N.A.
Total imports	47.8	22.9	23.4	24.7	26.6	N.A.
Imports re-exported:—						
Aircraft	0.3	0.7	2.4	N.A.	N.A.	N.A.
Engines	1.9	1.4	1.5	2.4	4.4	4.7
Total re-exports	2.8	2.1	3.9	N.A.	N.A.	N.A.

*First six months only

Chief: SIR ROY HARDY DOBSON, *managing director, The Hawker Siddeley Group.*

Stream-liner: DR. W. F. HILTON, *chief aerodynamicist, Sir W. G. Armstrong Whitworth Aircraft.*

Price-fixer: R. V. ALLAND, *senior executive in the contracts department, Alvis, Ltd.*

Third programme: CLIVE THOMAS, *head of analogue computer section, Blackburn and General Aircraft.*

INDUSTRY IN TRANSITION . . .

ment into believing that its rationalization policy is under way. Yet the fact is that such a device can provide the necessary institutional strength while preserving individual loyalty and flexibility. The other development is the creation of Bristol-Siddeley Engines, Ltd., reflecting the closer ties between Bristol and Hawker.

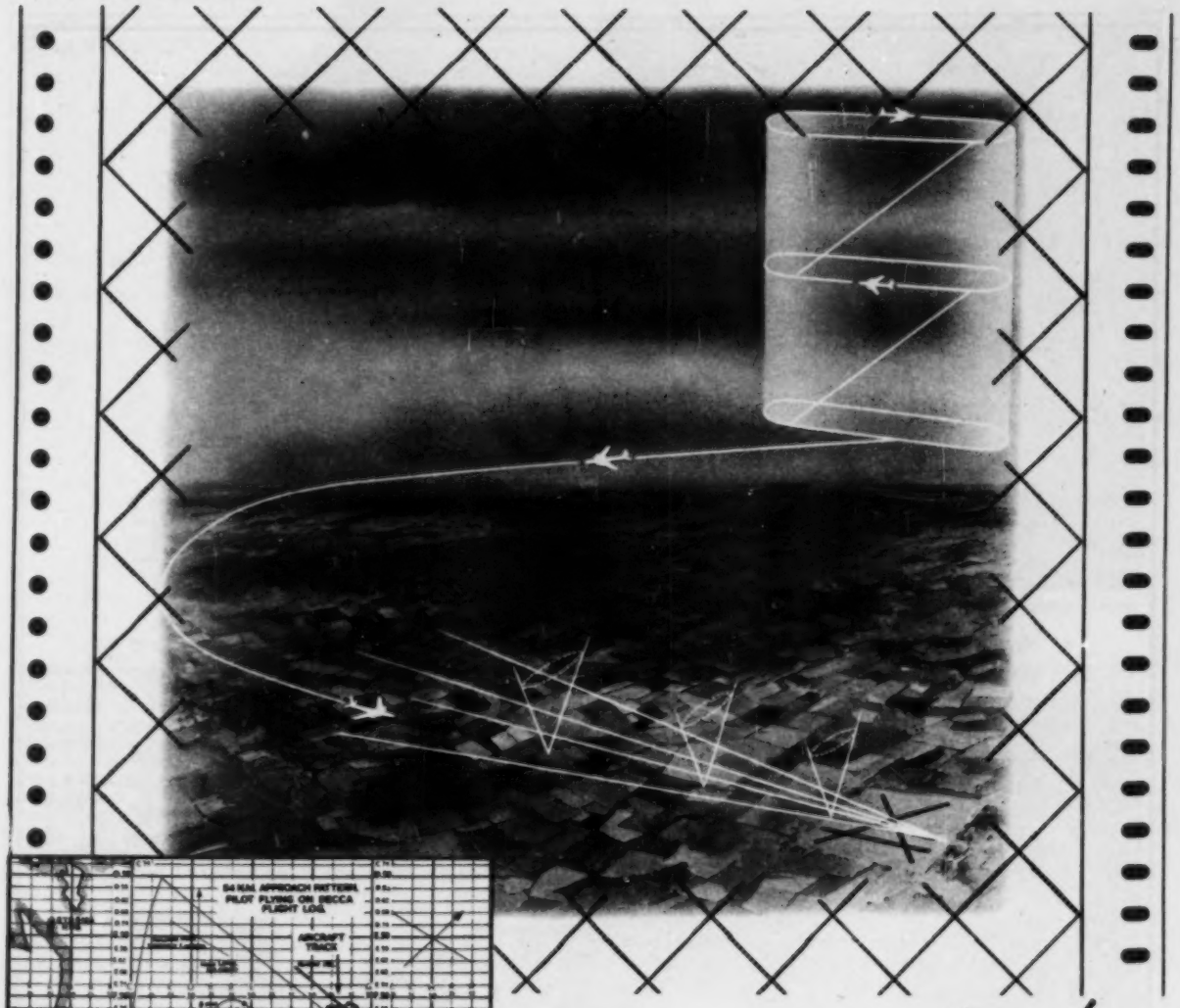
Investors' attitudes to individual aircraft shares are portrayed best by relating present market prices to the latest dividend rates and to past prices. Of eight major public companies concentrating on aircraft, only one currently yields less than the present average for all British industrial ordinary shares (6.1 per cent). To investors this company, Rolls-Royce, appears to have the soundest prospects of any in the industry. Two others, Bristol and Handley Page, are currently showing yields of the order of 10 per cent, this suggesting that these firms are considered to be speculative investments at the present time. Between these extremes stand the other five companies, most of which are now offering investors a return of about 7-8 per cent. Looked at as a whole, investment in aircraft shares appears to be considered a fairly risky venture.

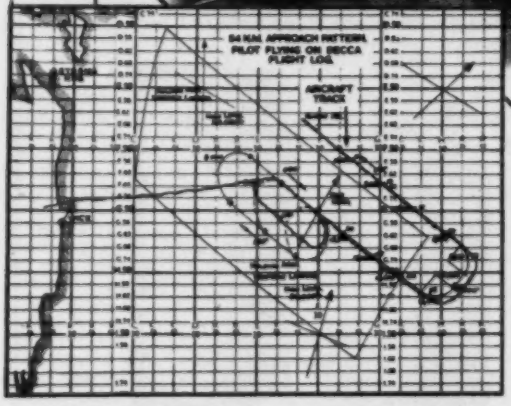
All aircraft shares are now standing well above this year's lowest levels. This is due to the general improvement in all share prices as credit restrictions have been eased and to a feeling that earlier fears on the industry's future were not wholly justified. A few shares are at present showing up particularly well: de Havilland, Fairey and Westland are each now at about the highest level for 1958. (Westland shares are only slightly below their 1957 peak, but those for the other two are well below last year's highest levels.) Blackburn, Folland, Handley Page and Rolls-Royce shares are at present standing about mid-way between the highs and lows for 1957 and 1958. Bristol shares, depressed by the considerable bank indebtedness associated with Britannia financing, stand at a relatively low level. In summary, the overall trend of market opinion is that investment in the aircraft industry appears now to be more risky than last year but less so than last spring.

In addition to the eight companies already considered, there are a further nine on which the investing public are unable to pro-

Casting director: MARY BELL, *pattern-maker in the precision foundry, Bristol Aero-Engines.*

Rug-cutter: JOHN CLEMENTS, *furnishing trimmer, Britannia assembly hall, Bristol Aircraft.*





In the trials held off the Orkneys, the holding area and runway were simulated exactly as for London Airport. In the above chart, used during the trials, the holding area with 4, 6 and 8 minute orbits is clearly shown together with the required track to the runway also clearly marked with altitude checks down to the threshold. With the Flight Log the pilot was able to navigate precisely at every stage of the flight, greatly simplifying the entire holding and approach procedure.

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INDUSTRY IN TRANSITION . . .

Looking ahead: C. T. WILKINS, *chief designer, de Havilland Aircraft, Ltd.*

TV watcher: RANJIT S. KHERA, *senior flight test observer, de Havilland Engine Company.*

nounce a clear verdict. Alvis, English Electric, Hawker Siddeley, Hunting, Napier and Vickers devote only a part of their energies to aeronautical activities. Auster, Saunders-Roe, Scottish and Short Bros. are private companies and are not obliged to publish complete accounts of their financial and productive condition. However, all the others publish annual reports and from the latest of these it is possible to study their individual fortunes:

Alvis, Ltd. In the year ended July 31, 1957 net profits rose fairly sharply to £207,862 (£159,482 the previous year). On net worth of £1.8m this was equivalent to a return of 11.3 per cent. The year saw "substantial orders" being placed for Leonides aero engines. On the motor-vehicle side of the business "we are now entering the production phase of the Saladin armoured car . . . a substantial order for [the fire-crash tender] has now been placed on behalf of the R.C.A.F. . . . we have other plans under consideration for retaining your company's long-established place in automobile engineering. Our prospects appear promising and the factory has a sufficient volume of orders in hand to keep it adequately employed throughout the (coming) year."

Blackburn and General Aircraft, Ltd. (year ended March 31, 1958). Net profits rose slightly from £514,356 to £547,104, giving a return of 12 per cent on net worth of £4.5m. "Turnover was almost identical with that of the previous year, and again aircraft work represented two-thirds of the total." In addition to work on the Beverley and NA.39, "the volume of work in the engine division continues to grow . . . orders for gas turbines have been received in substantial quantities." At the Dumbarton factory "work arising from Britannias and Beverleys is now to all intents and purposes completed" although civil engineering orders "for the current year might reach record proportions. Perhaps the most encouraging contract which has been awarded to us is that for the erection of six blocks of 15-storey flats for Paisley Corporation." Although one subsidiary, Thomas Green and Son, Ltd., "had a disappointing year (orders for road rollers have seriously declined), the results of another subsidiary, Jowett Cars, Ltd., were "thoroughly satisfactory" and plans were made "to introduce completely new products to offset lower spares production." In conclusion the chairman suggests "that the gloomy view which has been taken by so many people about the long-term prospects of the aircraft industry in this country may have been exaggerated."

Boulton Paul Aircraft, Ltd. (year ended July 31, 1957). Net profits fell slightly from £264,389 to £257,842, equivalent to 15 per cent on net worth of £1.7m. The report states: "We see no early signs of inability to maintain our manufacturing strength since our backlog of orders is not decreasing." Two other points of interest concern development of "a power steering for automobiles" and the appointment to the Board of Sir Harold Roxbee Cox (who is also a director of Wilmot Breeden and of Metal Box).

Bristol Aeroplane Co., Ltd. (year ended December 31, 1957) experienced a moderate fall in net profits from £1,065,028 to £806,296 (a return of 4.4 per cent on net worth of £18m). A major development was the creation of Bristol Siddeley Engines, Ltd., in recognition that Bristol Aero-Engines and Armstrong Siddeley "will pursue a joint research and development pro-

Heat-seeker: DR. G. H. HOUGH, *assistant chief engineer, de Havilland Propellers.*

Mach-buster: ROLAND P. BEAMONT, *manager, flight operations, The English Electric Company, and* ARTHUR TALBOT, *ground-staff fitter.*

Roto-dyner: J. J. HILLARD, *experimental flight manager, The Fairey Aviation Company.*

Quartermaster: JIM HOLLAND, *storekeeper, Folland Aircraft.*

INDUSTRY IN TRANSITION . . .

Super structure: J. F. CUSS, *chief stressman, Gloster Aircraft.*

Diplomat: IAN H. BROWN, *sales manager, Hunting Aircraft.*

gramme and will pool their technical and manufacturing resources in relation to all new projects initiated by the Ministry." It is hoped that this "will lead progressively to a close and complete identity of purpose." The only reference to diversification of the company's non-aviation interests is an expression of "our hope that in due time a significant portion of the company's turnover will be derived from applying to the field of nuclear energy (our) exceptional if not unique knowledge of the behaviour of metals at high working temperatures."

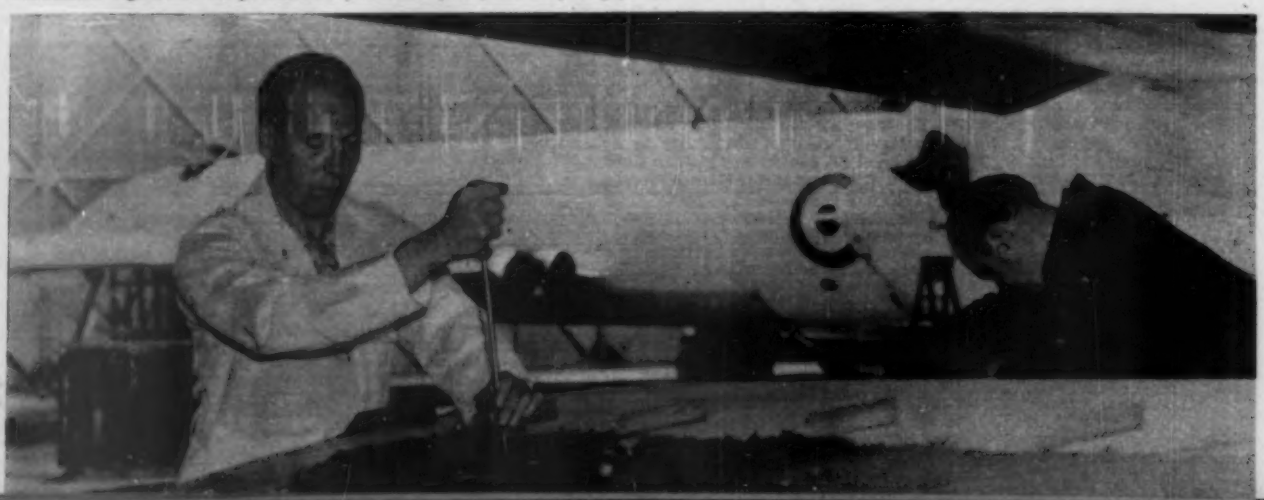
de Havilland Holdings, Ltd. (year ended September 30, 1957). Net profit fell sharply from £1,659,238 to £619,611, equivalent to a return of 3.1 per cent on net worth of £20m. (1957 figures were reached after expenditure of £1.3m on jigs and tools had been carried forward to a later year.) This is attributed to the fact that "we completed deliveries of existing types but did not gain appreciable benefit from our expenditure on new products." The company also received "less support from the Government in meeting the cost of research and development." Looking to the future "the Group order position is sound (but) we are studying very carefully other fields of industry to which our experience can be put to useful purpose."

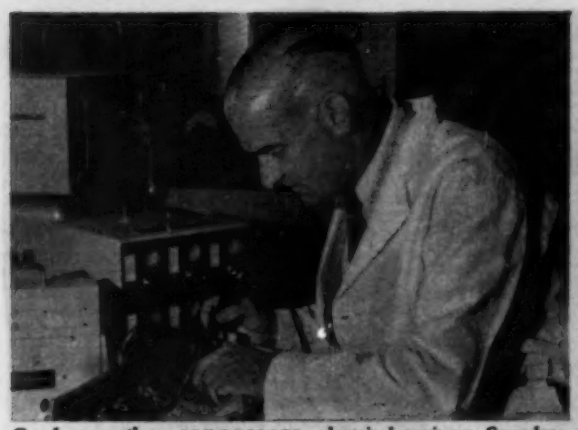
English Electric Co., Ltd. (year ended December 28, 1957). Net profits were substantially unchanged at just under £3m on net worth of £54.5m (a return of 5 per cent). Only a small proportion of this represented the company's aircraft and aero-engine activity.

Fairey Aviation Co., Ltd. (year ended March 31, 1957). Net profit increased in this year from just under to just over £1m on net worth of £6.6m. (Unfortunately, no details will be available until November for the financial year just ended.) The chairman noted: "your Board's policy of broadening its activities is continuing to have its effect . . ."

Folland Aircraft, Ltd. (year ended June 30, 1957). The excel-

Turbulator tightener: H. J. ALBROW, *erection fitter, Handley Page, Ltd.*





Good connections: JOE DRISSEL, *electrical engineer, Saunders-Roe Helicopter Division.*

And his mate: DAVID DAND, *head riveter, Experimental Department, Scottish Aviation, and* JOCK SINCLAIR.

lently presented accounts of this company recorded a fall in net profits from £83,828 to £31,315 (a return of 3 per cent), reflecting to a large degree a reduction in sub-contract work (particularly Britannia nacelles). Nevertheless, orders in hand amounted to £6m, equivalent to nearly three years' work at the 1957 level.

Handley Page, Ltd. (year ended December 31, 1957). A sharp fall in profits (£341,176 to £127,870) was experienced last year, the return on net worth (£3.7m) being reduced to 3.4 per cent. "The nucleus of a commercial division, newly formed by us, is actively investigating the possibility of broadening the basis of your company's production."

Hawker Siddeley Group, Ltd. (year ended July 31, 1957). Net profits fell from £5.8m to £5.1m (8 per cent return on net worth of £64m). In the intervening months since publication of the report the Group has continued to expand into new fields, and aviation is now believed to account for one-fifth of total activity.

Rolls-Royce, Ltd. (year ended December 31, 1957). Last year was highly successful, sales rising from £81m to £92m, and net profits from £2.1m to £2.3m (8 per cent on net worth). Despite the considerable successes of the company's aero-engine division, Rolls-Royce continued to develop new versions of their land and marine engines and their motor-car division. Research was also conducted into various aspects of nuclear engineering.

Saunders-Roe, Ltd. While facing "a difficult period of adjustment," this company is "fortunate in having other interests not directly connected with aircraft which they might be able to expand."

Short Bros. and Harland, Ltd. Although curtailment of the Seamew contract "resulted in the level of turnover and profitability failing to increase . . . the Britannia programme, a new guided weapon and the M.o.S. sponsored VTOL research aircraft hold out better promise for the future."

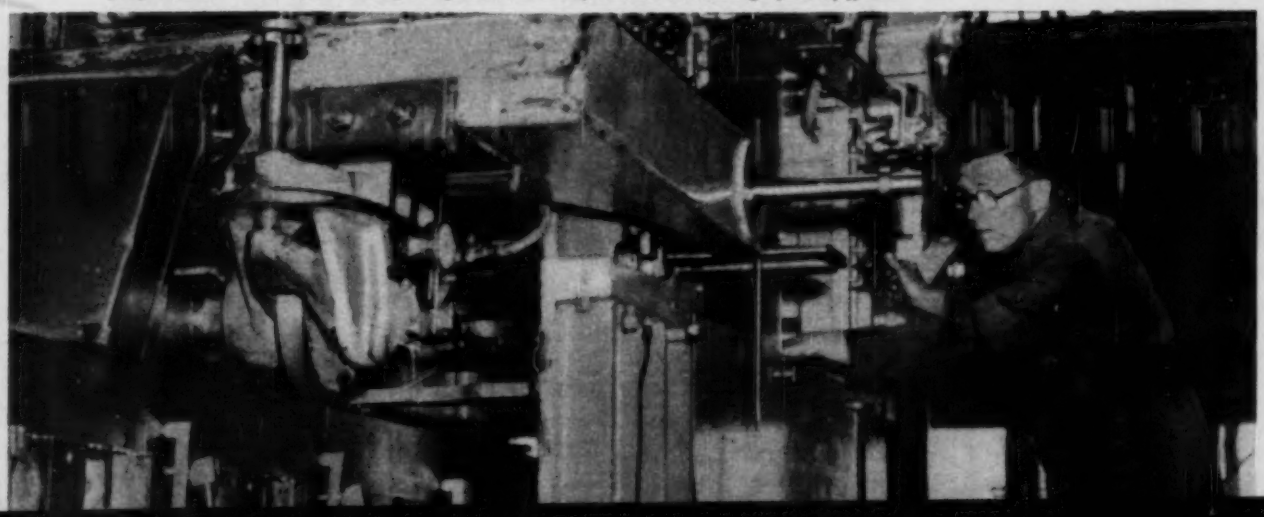
Vickers, Ltd. (year ended December 31, 1957). Group net profits rose last year from £6.2m to £6.4m on net worth of £96.4m. As in the case of English Electric, aircraft only accounted for a lesser share of overall activity (the actual proportion was about one-quarter of sales as against one-third in 1956). The gap between phasing-out of the Viscount and getting the Vanguard into service may reduce the proportion further this year.

Westland Aircraft, Ltd. (year ended June 30, 1957). Group net profits (including results of Normalair) increased rapidly from £476,983 to £567,885, while net worth rose from £2.5m to £4.4m. The company's future position is described as one "of sufficient strength to enable us to look to the future with reasonable confidence."

J. C. S.

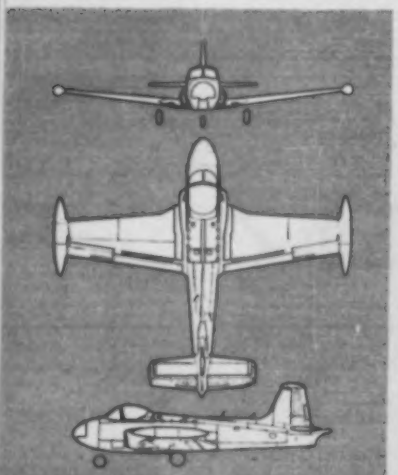
Fireman: JIM VEIGHEY, *crash-crew member, Short Brothers and Harland, Ltd.*

Jolly Miller: G. A. WILLSHIRE, *Vanguard machinist, Vickers-Armstrongs (Aircraft), Ltd.*



Hunting Aircraft, Ltd.

Luton Airport, Luton, Beds. Telephone: Luton 6060

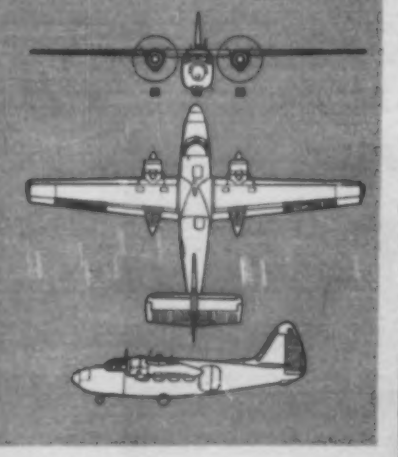


Hunting Jet Provost T.3 (drawing and photograph above)

Powerplant	Armstrong Siddeley Viper ASV.8
Span	36ft 11in
Length	32ft 5in
Gross weight	7,092 lb
Maximum speed	330 m.p.h.

Hunting President (drawing and photograph below)

Powerplant	Two Alvis Leonides
Span	64ft 6in
Length	46ft
Gross weight	13,500 lb
Typical cruising speed	191 m.p.h.



Jet Provost T.3 The R.A.F. has now ordered the Jet Provost T.3 as the standard *ab initio* basic trainer for the R.A.F.; and the first production machine has flown. Hunting have thus produced the first Jet Trainer ever to be standardized by any air force for primary training.

Extensive Service trials have already been carried out, taking pupils with and without previous pilot experience through the primary stage of flying training. The results have shown that the Jet Provost gives the pupil a better understanding of flying and a more advanced ability, especially in aerobatics, for a given number of training hours. In addition Hunting have produced an armed version of the Jet Provost for use in weapon training and police work. This would carry two 0.303in machine guns in the fuselage, just behind the engine intakes, and, variously, eight 25 lb bombs and four, six, eight or twelve rockets, under the wings.

The Armstrong Siddeley Viper ASV.8 turbojet is mounted in the centre fuselage, where it is easily accessible through large hinged panels. These panels can be completely removed to facilitate engine-changes. A generator and hydraulic pump are driven from a gearbox mounted on the cabin rear bulkhead and driven by a shaft from the front of the engine. The nosewheel undercarriage is retracted by a single hydraulic ram operating a cable system connected both to the legs and the fairing doors. In emergency the undercarriage will lower and lock under gravity. Airbrakes and lift spoilers are mounted respectively below and above the wing ahead of the flaps which are themselves hydraulically operated.

Pupil and instructor sit side-by-side under a sliding clear-view canopy in Martin-Baker Mk 4 ejection seats. Radio and electrical equipment is housed in a nose compartment behind a hinged nose cone providing ready access. Compressor bleed air is used for heating the cabin, but pressurization is not applied. Normal fuel capacity is 186 Imp. gal contained in tanks in the wing structure; and two 50-gal tip tanks can be attached to increase range to 490 nautical miles or cruising endurance to 2.45 hr.

The detailed description and cutaway drawing of the Jet Provost published in *Flight* for June 13 illustrates the simplicity of the structure and systems. Yet the Jet Provost carries D.M.E. and full blind-flying instrumentation in addition to V.H.F. or U.H.F. radio.

In designing the Jet Provost Hunting aimed at producing docile flying characteristics and good training qualities, and did not attempt to obtain the maximum performance with the engine power available. Experience has shown this to be fully justified. During 1956 and 1957 fifty R.A.F. pupils were trained in the Jet Provost. Of these 35 had no previous flying experience and 15 had flown light piston-engined types. One failed to make the solo stage; and of the 35 without previous flying experience the lowest recorded time to first solo was 7 hr 5 min. The average for all 35 was 10 hr 10 min. Of the 14 with previous experience the lowest recorded time to solo was 4 hr 25 min, and the average for the 14 pupils was 7 hr 25 min. During the recent South American sales tour a Jet Provost spent fourteen days training five Peruvian pilots to first solo stage. Three of them were trained by a Peruvian officer and the other two by a Hunting pilot; and all reached solo standard in the required time. Fifty-five hours were flown and no trouble whatever experienced with the aircraft. Side-by-side seating contributed very considerably to overcoming the language difficulty.

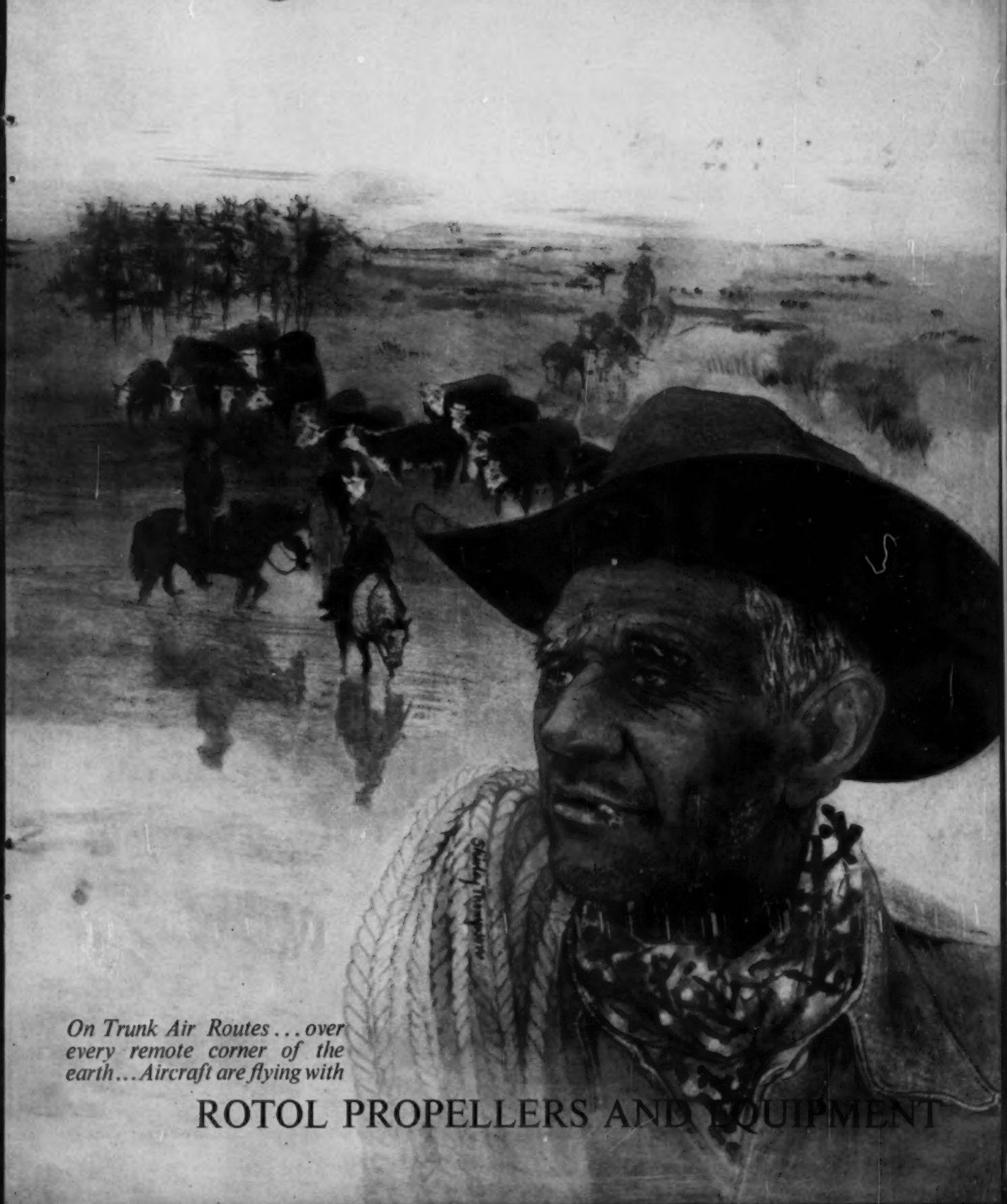
Pembroke and President The Pembroke has been in R.A.F. service since 1952 and has also been adopted by the air forces of Belgium, Denmark, Finland, Rhodesia, Sweden and West Germany. The type can carry up to twelve passengers and all fixed fittings are available for quick conversion for freighting, supply dropping, air/sea rescue, photographic survey, navigation and radio or radar crew training, casualty evacuation and twin-engine pilot training. A clear headroom of no less than 6ft and a volume of 620 cu ft make the cabin most useful for all these rôles; and the wide main door will accept bulky items and can be removed to permit parachuting of freight and equipment.

The President is a direct civil adaptation of the Pembroke and maintains the versatility and usefulness of the military type. It can, in addition, be most luxuriously appointed for V.I.P. and executive transport, and a great variety of accessories can be provided. In an executive version the cabin is fitted with six seats and two tables, together with a toilet compartment, refreshment cabinet and wardrobe. For survey work, the President provides a stable camera platform at heights in excess of 20,000ft and both vertical and oblique cameras, as well as geophysical survey instruments, can be carried. The ambulance layout allows for up to nine stretchers.

H.107 This interesting design-project is a twin-jet 48-seat transport for stages of about 800 st. m. at a cruising speed of 460 m.p.h. Maximum still-air range is 1,550 st. m.

The project is aimed at filling the only remaining "turbojet gap" in air transport—the local service and feederline routes where, believe Hunting, "the higher frequencies offered by a turbojet transport would show economic advantages."

Powerplant would be two Bristol Orpheus 810 turbojets of 5,200 lb thrust each; gross weight, 41,500 lb; maximum payload, 10,960 lb; fuel, 17,480 lb.



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This, the "drapery" type of Aurora Borealis, is — like others — developed when electrically charged particles ejected from the sun enter the earth's magnetic field and ionise the atmospheric gases, causing the excited atoms to discharge light rays of different colours.
The aircraft shown is based on informed opinion of the types likely to be employed on stratospheric flight. For such flight Esso are already developing fuels and lubricants which will be efficient at both extreme low and high temperatures.

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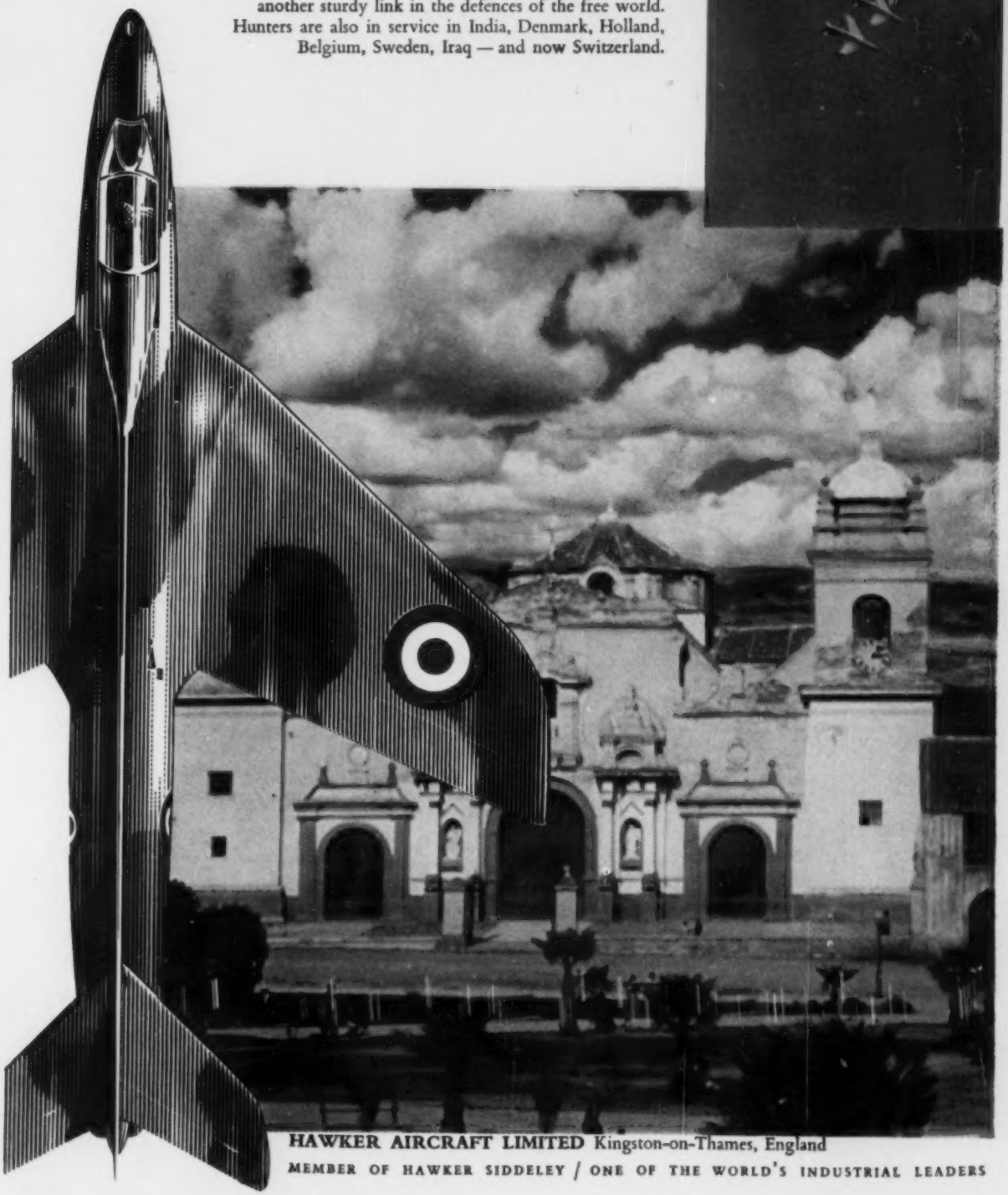
Hunters Defend PERU

Speed, offensive power and great versatility have given the Hawker Hunter pride of place in the air forces of many countries, including Peru. Today several squadrons of Hunters are in service with the Peruvian air force, forging another sturdy link in the defences of the free world. Hunters are also in service in India, Denmark, Holland, Belgium, Sweden, Iraq — and now Switzerland.



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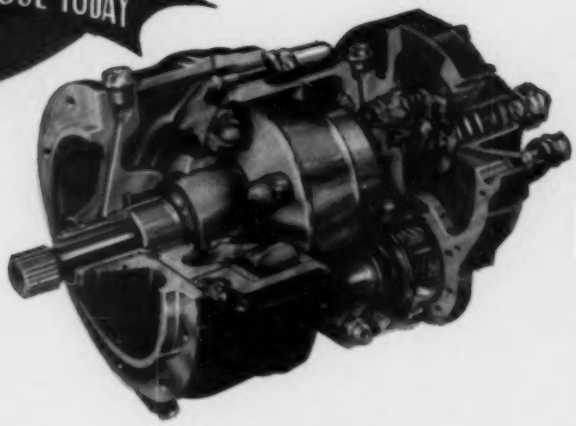

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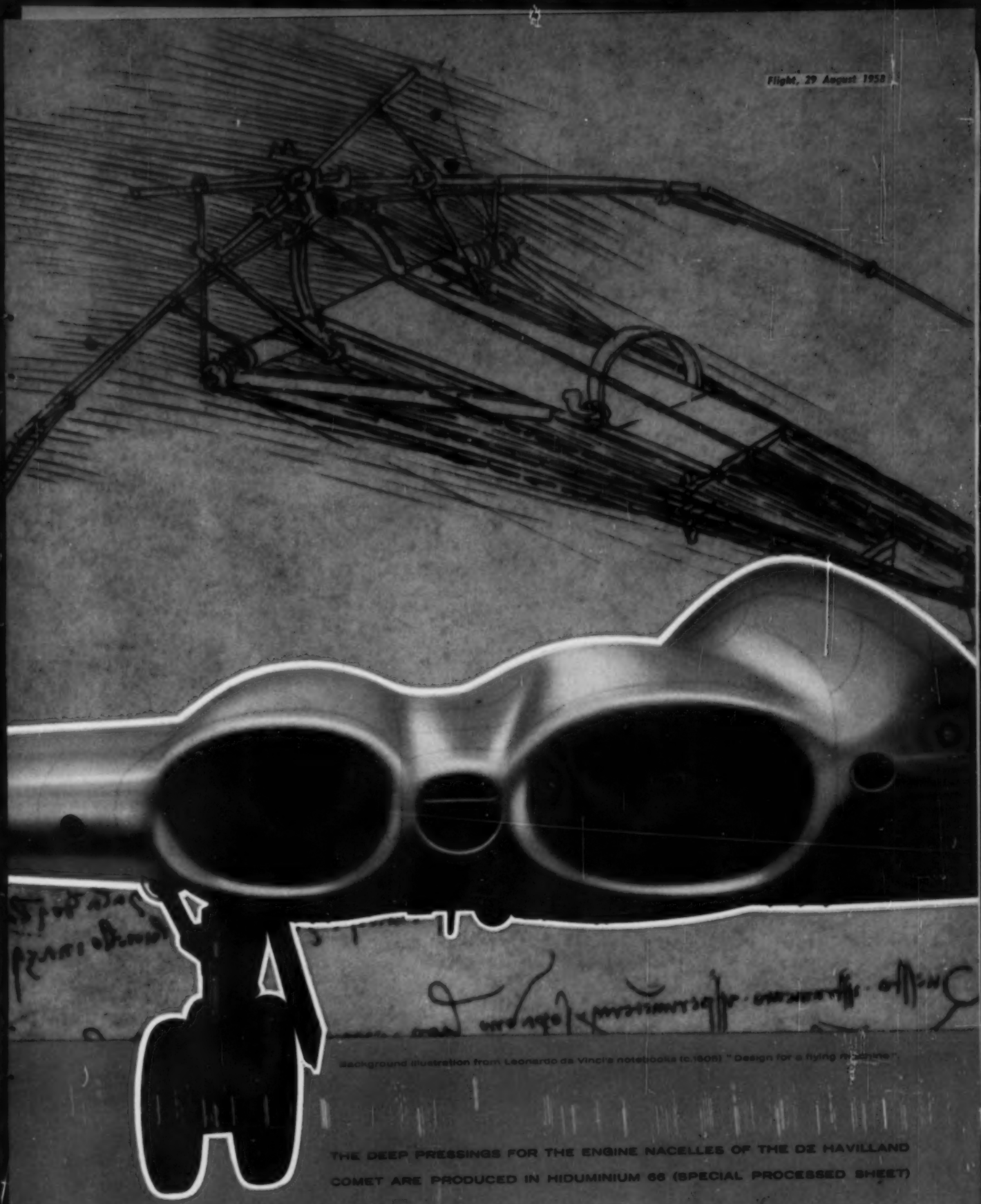

Background illustration from Leonardo da Vinci's notebooks (c.1505) "Design for a flying machine"

THE DEEP PRESSINGS FOR THE ENGINE NACELLES OF THE DE HAVILLAND COMET ARE PRODUCED IN HIDUMINIUM 66 (SPECIAL PROCESSED SHEET)

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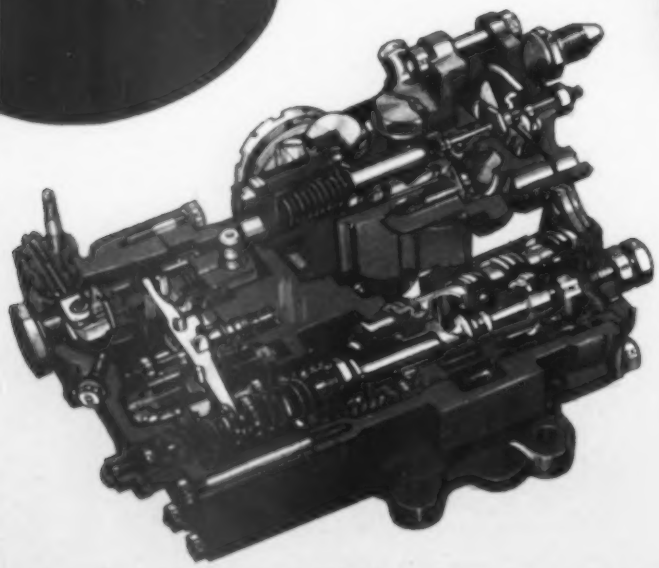

ACCELERATION CONTROL

The acceleration-control positions the spill valve to control the spill flow from the burners, thereby limiting the flow to the engine to a pre-determined amount. Overheating and compressor surge is thereby averted at all altitudes.

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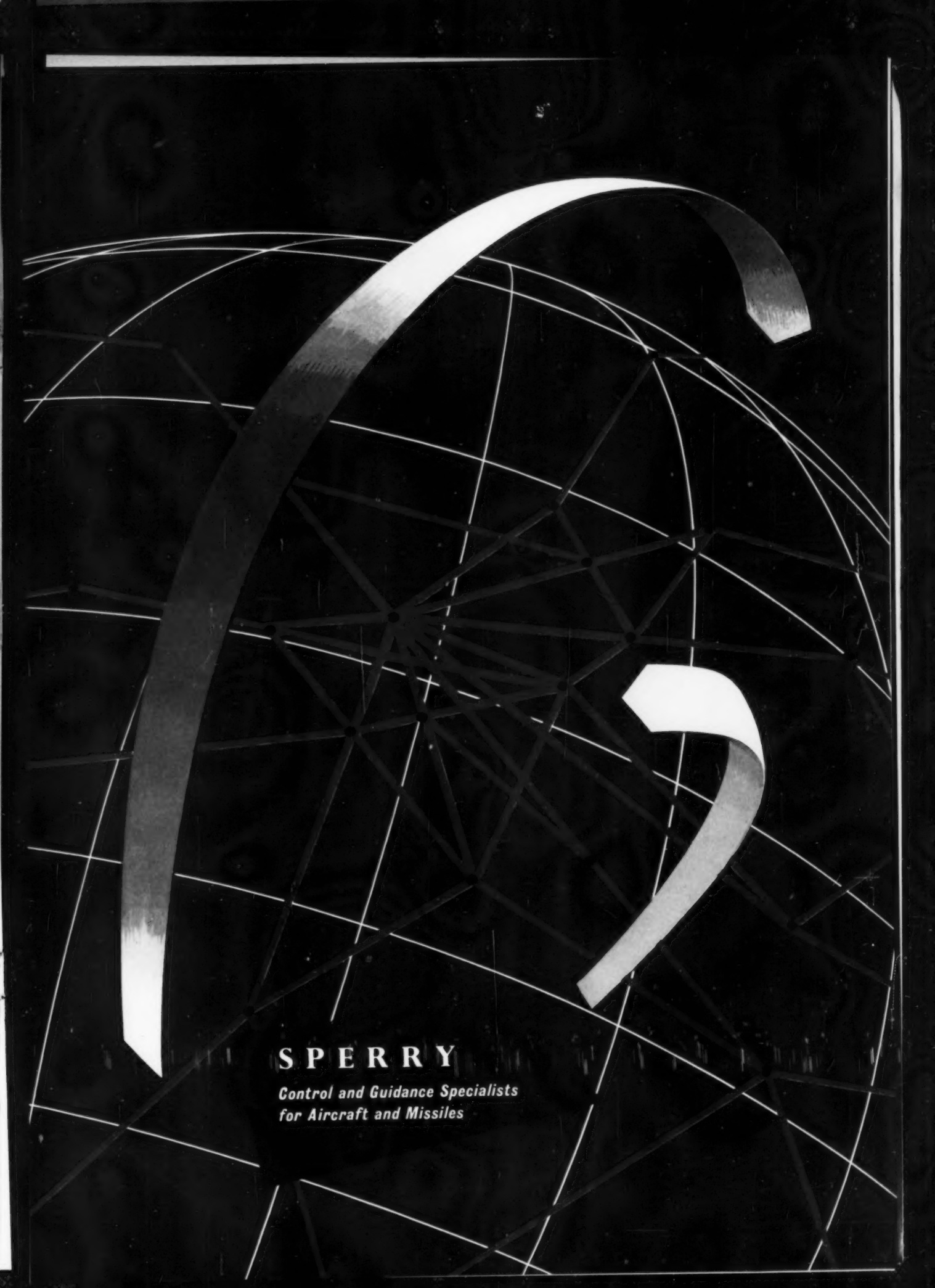
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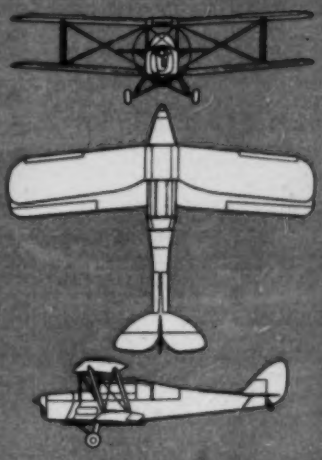


Thruxton Jackaroo (drawing and photograph above)

Powerplant	D.H. Gipsy Major 1 or 1F
Span	30ft 4½in
Length	25ft
Gross weight	2,100 lb
Cruising speed	88 m.p.h.

Miles Student Mk 1 (drawing and photograph below)

Powerplant	Turboméca Marboré IIA
Span	29ft 2in
Length	30ft 9in
Gross weight	4,000 lb
Maximum speed	380 m.p.h.

Jackaroo Aircraft, Ltd.

Thruxton Aerodrome, Thruxton, Andover, Hants. Telephone: Weyhill 304

Thruxton Jackaroo This popular conversion of the D.H.82A Tiger Moth is available as a four-seat-cabin tourer, and also as a crop-duster, crop-sprayer, light freighter, dual trainer and ambulance.

About 98 per cent of the basic Tiger Moth components are retained, and the conversion—which costs (July 1958) £800—entails modification of the cockpit portion of the fuselage, which is made one foot wider and is also lengthened. A new Jackaroo costs £1,270 at present prices, which justifies Thruxton's claim that the aircraft is the cheapest four-seat aircraft in the world.

The advantage of easily obtainable spares is important for the Jackaroo owner; there are few parts of the world where Tiger Moths—10,000 of which were built—are not in service. The D.H. Gipsy Major I, which has an approved overhaul life of 1,500 hr, is retained unchanged.

Jackaroo Aircraft are at present working on orders from South America and Australia, the last-named country having recently approved the aircraft in the private category. The aircraft can be fitted with Palmer brakes, and also with night-flying equipment, at extra cost. Tankage is 19 Imp. gal, giving a cruising endurance of 2.75 hr. Maximum speed, as convincingly demonstrated at this year's National Air Races, is 105 m.p.h.

For the crop-duster or crop-sprayer version of the Jackaroo a hopper or a 60-gal tank can be installed in place of the two front seats. Alternatively the aircraft will carry a load of five or six hundredweight.

F. G. Miles, Ltd.

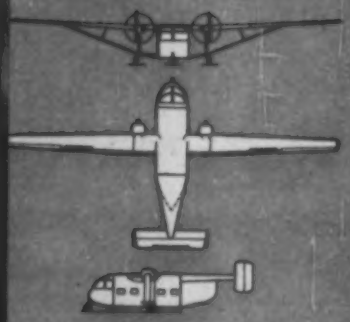
Shoreham Airport, Sussex. Telephone: Shoreham-by-Sea 2301

Student Considerable flying time has now been amassed with the first Student, powered by a Blackburn Marboré 2 giving 880 lb thrust; and the aircraft recently departed on a sales and demonstration tour of Scandinavia. During several public demonstrations the Student has shown remarkable docility and manœuvrability, and its cost is quite low.

The all-metal, slightly swept wing is mounted at shoulder level behind the side-by-side two-seat cockpit, engine air being drawn through a flush intake over the cockpit roof. Elevator feel is provided by adjustable anti-balance tabs, the control surface being hinged at its centre of pressure. Twin fins and rudders are mounted at the extremities of the tailplane. The nosewheel undercarriage retracts into the fuselage. Large, car-type floor-level doors in either flank of the cabin may be jettisoned to allow easy escape in an emergency.

As an alternative to the single Marboré powerplant, two Palas engines, together providing 700 lb thrust, may be fitted; alternatively a Rolls-Royce RB.108 or a Turboméca Gourdon or Arbizon may be installed to provide a considerable increase in thrust and correspondingly higher performance. In these versions the type is known respectively as the Centurion 3, 4 or 5. Underwing stores and guns can be fitted.

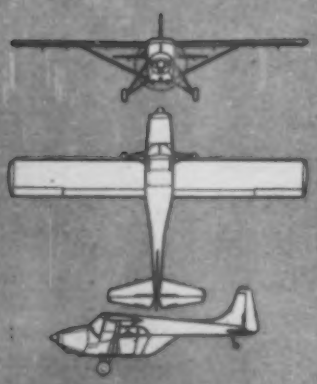
Representative underwing armament loads include pods carrying 31 5 cm rockets, six R.P.s or eight 25 lb bombs. The pylons for these each contain a 0.303in machine-gun with 350 rounds of ammunition. The Student stands sufficiently low on the ground to be readily accessible for both routine or major maintenance operations.



Miles (HDM.106 Caravan (drawing above)
Powerplant ... Two Lycoming GSO-480B
Span 75ft 4in
Gross weight ... ... 8,000 lb
Cruising speed ... ... 129 m.p.h.

M.L. Utility Mk 1.

Edgar Percival EP.9 (drawing and photograph below)
Powerplant ... ... Lycoming GO-480B
Span 43ft 6in
Length 29ft 6in
Gross weight ... ... 4,150 lb
Cruising speed ... ... 125 m.p.h.



Miles HDM.105.

HDM.106 Caravan This ingenious light transport project is the outcome of Anglo-French co-operation in the form of a technical partnership between Miles and Hurel-Dubois. Back in 1955 the two concerns formed a joint company to demonstrate the efficiency of the H.D. high-aspect-ratio wing formula when applied to a light transport. The immediate outcome was the HDM.105, which is in effect an Aerovan test-vehicle for the 75ft 4in-span, 20.5-A.R. wing. It has performed well, as a handling description in *Flight* of June 6, 1958, testified.

The HDM.106, which will be the developed production aeroplane, is to be powered by two Lycoming GO-480s of 290 b.h.p. each, or two supercharged GSO-480Bs each of 340 b.h.p.

Gross weight will be 8,000 lb; take-off to 50ft (supercharged version) 444 yd; minimum ground run 93 yd. Tankage is 150 Imp. gal, and maximum payload 3,040 lb (freight) or 15 passengers; range with this payload in I.F.R. conditions and fuel allowances is 210 st. miles.

Though the HDM.106 Caravan promises to be an excellent light transport (NATO have expressed strong interest in it as a close-support transport for the Fiat G.91 light attack squadrons), a relatively small company like F. G. Miles, Ltd., are not able to undertake series production. Nevertheless, larger concerns, either in Britain or abroad, might well consider it a highly profitable venture in view of the large market which undoubtedly exists.

M. L. Aviation Co., Ltd.

White Waltham, Berks. Telephone: Littlewick Green 248

M.L. Utility Designed for special operations such as aircrew rescue, the M.L. Utility has an inflatable wing of delta plan-form fitted with inflatable elevon-type control surfaces. Two occupants sit in tandem in a small wooden gondola beneath the wing. The first Utility had a Walter Mikron engine derated to 35 h.p. mounted behind the gondola; and the nosewheel undercarriage is directly steerable from the rudder bars. The wing may be deflated and stowed in the gondola for towing by a road vehicle; or the whole machine may be packed and dropped by parachute. Development was conducted under a contract from the Ministry of Supply.

Edgar Percival Aircraft, Ltd.

Stapleford Tawney Aerodrome, Abridge, Essex. Telephone: Theydon Bois 2321

EP.9 The future of this most attractive agricultural and general-purpose aircraft is now in doubt, following the recent liquidation of Edgar Percival Aircraft, Ltd.

Primarily designed for agricultural operations, the EP.9 is adaptable also as a six-seater or light freighter. Powerplant is a Lycoming GO-480B of 340 h.p. Dual control is provided, and—to avoid the corrosive effect of agricultural fluids—the fuselage is constructed of welded steel tube. In the top-dressing rôle a ground crew of three can be carried in addition to the pilot and the hopper.

EP.9s are in service in the United Kingdom, Australia, Canada, New Zealand, Germany, Algeria, Libya, Vietnam and other countries. The example illustrated below is equipped for spraying.

Saunders-Roe Skeeter Mk 12.

Saunders-Roe, Ltd.

Osborne, East Cowes, Isle of Wight. Telephone: Cowes 2211

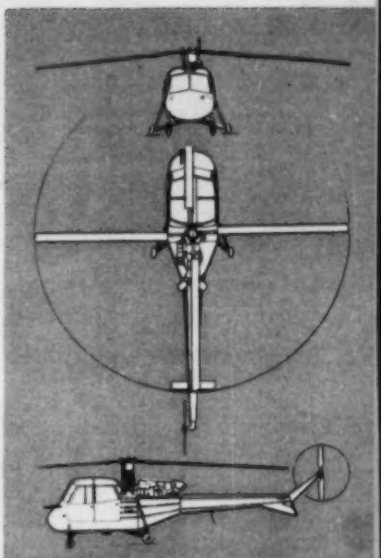
P.531 In little over six months from January 1 this year, Saunders-Roe have progressed from the first design study to the first flight of the prototype of this promising new helicopter. Though virtually the same size as the Skeeter, the P.531 seats five people in a large cabin forward of the rotor. The rotor itself bears a marked resemblance to that of the Skeeter, but has four blades instead of three; and the tail boom and tail rotor are substantially the same as those of the Skeeter except for increased tail rotor blade chord. A four-wheel undercarriage is fitted.

The fuselage is a simple sheet-metal structure in which the main cabin loads are taken by two keel members, affording the maximum accessibility to control runs and systems installed either side of the keels. The cabin layout can, of course, be greatly varied to accommodate stretchers or freight; and a Lucas air-driven 440 lb hoist can be attached. The centre fuselage structure houses three flexible fuel tanks holding a total of 126 Imp. gal. Aft of the fuel tanks there is accessible internal stowage for batteries, equipment and a considerable quantity of luggage. The top decking of this section forms a steel floor upon which the Blackburn Turmo of 425 s.h.p. is mounted. The free turbine drive is taken from the rear of the engine, transferred downwards by spur reduction gears and divided fore and aft to main- and tail-rotor gearboxes. Rotor speed is maintained constant regardless of rotor load according to a governor setting. A belt-driven oil cooler and a shaft-driven oil pump are also mounted beside the engine. A three-axis auto-stabilizer and, possibly later, a full autopilot are being fitted, but no power assistance is thought necessary for the normal flying controls.

The main rotor pylon is mounted by steel tubes from the top of the fuselage proper, just aft of the cockpit section. Underneath this is located the principal reduction gearbox, total engine-to-rotor reduction being 67:1. The unit is essentially similar to that used in the Skeeter although, as the drive comes in from the rear instead of from the starboard side, the whole unit is turned through 90 deg. The rotor head carries flapping hinges and both friction and rubber-block anti-drag devices for each blade. The blades themselves may be folded rearwards to lie in line with the tail boom. Both tail- and main-rotor blades are to be made by Hordern-Richmond using their traditional composite spruce, balsa and glass plastics structure.

The second P.531 may have flown by the time this issue appears. A detailed description and cutaway drawing of the P.531 were featured in *Flight* for August 8.

Skeeter Delivery of the latest Mk 12 variant of the Skeeter is now under way to the R.A.F., the British Army and the Army and Navy of Western Germany. The powerplant is a de Havilland Gipsy Major 215 giving 215 h.p., mounted athwartships beneath the rotor pylon. Cooling air is entrained by a fan and either water/methanol injection or a quickly detachable turbo-supercharger may be applied to restore sea level take-off power at altitudes up to 4,000ft. In addition, Napier have developed a rotor-tip rocket boost installation; and some of these units are being supplied with German machines. They give the Skeeter exceptional vertical-climb capability. Accommodation is for two side-by-side with full dual controls.



Saunders-Roe P.531 (drawing above and photograph above, left)

Powerplant	... Blackburn Turmo 600
Rotor diameter	... ... 32ft 6in
Fuselage length	... ... 29ft
Gross weight	... ... 3,880 lb
Cruising speed	... ... 115 m.p.h.

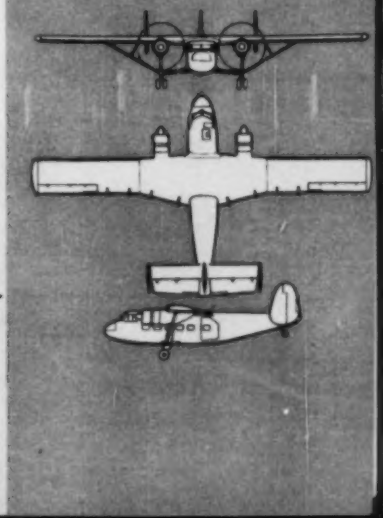
Scottish Aviation, Ltd.

Prestwick Airport, Ayrshire, Scotland. Telephone: Prestwick 79888

Twin Pioneer Both civil and military orders have been placed for this outstanding STOL type, both versions being powered by a pair of Alvis Leonides piston engines. The military version can, in addition to carrying freight and personnel, be fitted with a variety of armament loads including 1,000 lb, 500 lb and 250 lb bombs or supply containers, carried on racks built into the undercarriage stub wings. The aiming position is located, with weapon release gear, in the forward part of the cabin floor. A civil Twin Pioneer delivered to the Austrian State Forestry and Survey Bureau was fitted to carry large vertical survey cameras. This installation was made because it was necessary over Austria to fly steadily at between 1,000 and 5,000ft at speeds in the

Scottish Aviation Twin Pioneer CC.1 (drawing below and photograph below, left)

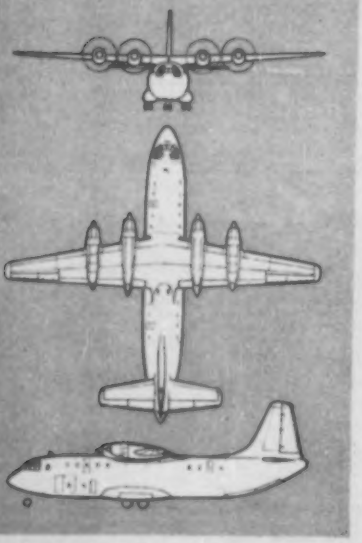
Powerplant	Two Alvis Leonides 514/8
Span	... ... 76ft 6in
Length	... ... 45ft 3in
Gross weight	... ... 14,000 lb
Cruising speed	... ... 126 m.p.h.



British Aircraft 1958

Short SC.1 (drawing above and photograph below, right)
Powerplant Five Rolls-Royce RB.108 (four used for lift and one for propulsion)
Span 23ft 6in
Length 24ft 5in (29ft 10in with probe)

Short PD.18 Britannic 1 (provisional drawing and artist's impression below)
Powerplant Four Bristol Proteus 255
Span 142ft 3in
Length 135ft
Gross weight ... ... 183,500 lb
Cruising speed ... ... 350 m.p.h.



region of 70 m.p.h. Only types such as the Twin Pioneer are capable of doing this with such a load. Other Twin Pioneers have been delivered to Kuwait, Persia, the Far East, South Africa and Borneo; and a group of aircraft specially fitted with Pratt and Whitney R-1340 engines is being delivered to Philippine Airlines. Twelve Twin Pioneers of a substantial order were recently delivered together to the R.A.F.

Scottish Aviation have also developed a special V.I.P. conversion kit for the Twin Pioneer cabin including special furnishing, seats, refreshment and food cabinets and bulkheads, all of which can be installed in a matter of hours in the field. One of these kits went to Persia and another was installed in a Twin Pioneer delivered to the government of Malaya.

The Twin Pioneer should provide the R.A.F. with an aircraft of unique capabilities and capacity and a worthy complement to the single-engined Prestwick Pioneer. For police actions in remote areas it is almost ideally suited for the type of sustained and leisurely bombardment which has been found to be most effective in dealing with tribal disorders. In such circumstances jet fighters are expensive and difficult to operate; and they often produce less effective results.

Short Brothers and Harland, Ltd.

Queen's Island, Belfast, Northern Ireland. Telephone: Belfast 58444

PD.18 Britannic The present controversy over the future equipment of R.A.F. Transport Command centres on a number of new aircraft projects. Among these, one of the more favoured —so it is unofficially reported—is Short's study for the Britannic, a heavy freighter using a large number of Britannia components.

Essentially, the Britannic has a Britannia wing and powerplant system mounted high on a completely new fuselage having a volume about 50 per cent greater than that of the commercial airliner. The project is planned to have four stages, the same design of fuselage being common to each. This has an overall usable length of 80ft and a floor-width of 12ft. Up to 150 passengers can be accommodated, and a large rear ramp and big forward doors permit the loading of heavy equipment and vehicles and subsequent air-dropping. The fuselage is fully pressurized.

Britannic 1 would have four Bristol Proteus 255 of 4,445 e.h.p. each; a gross weight of 183,500 lb; a capacity payload of about 60,000 lb; and a range of 2,900 st. miles carrying 36,000 lb payload at 350 m.p.h.

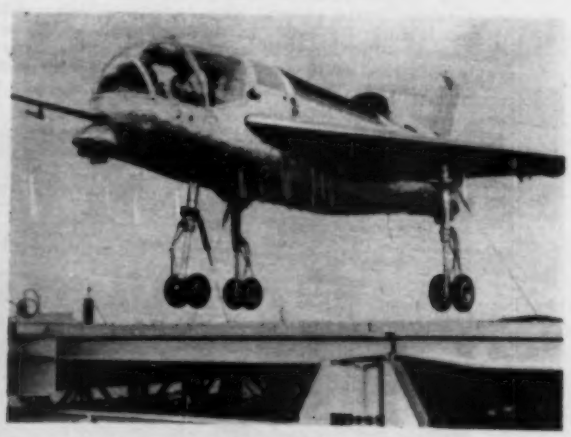
Britannic 2 would have increased power, more payload and improved performance. The Britannic 3 would have four Rolls-Royce Tynes, further improving lifting capabilities and performance. The Britannic 4 would have later-model Tynes and a new wing, permitting a cruising speed of up to about 450 m.p.h. and a maximum payload of about 95,000 lb. At present the Britannic remains a project; the version which may be built depends upon the nature and the timing of the Government's requirements.

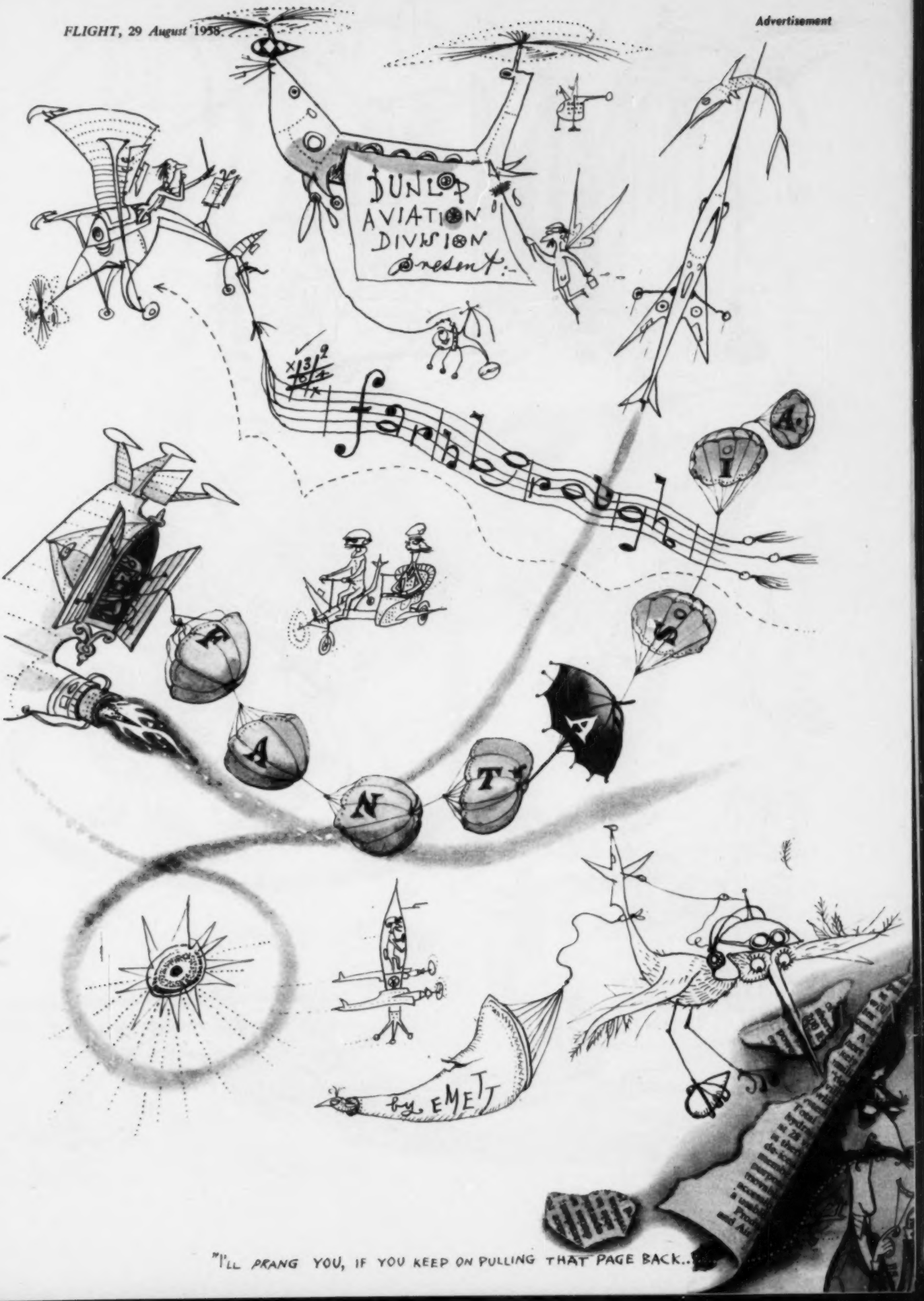
SB.5 Since it first flew in December 1952, this adjustable-wing research aircraft has facilitated the collection of a vast amount of data. It has particularly been employed upon research into the behaviour of highly swept wings at low speeds, and is shortly to fly with wings swept at 69 deg, the greatest degree of sweep yet to take the air. Powerplant of the SB.5 in its revised form will be a Bristol Orpheus, which will permit flight at greater weight than hitherto.

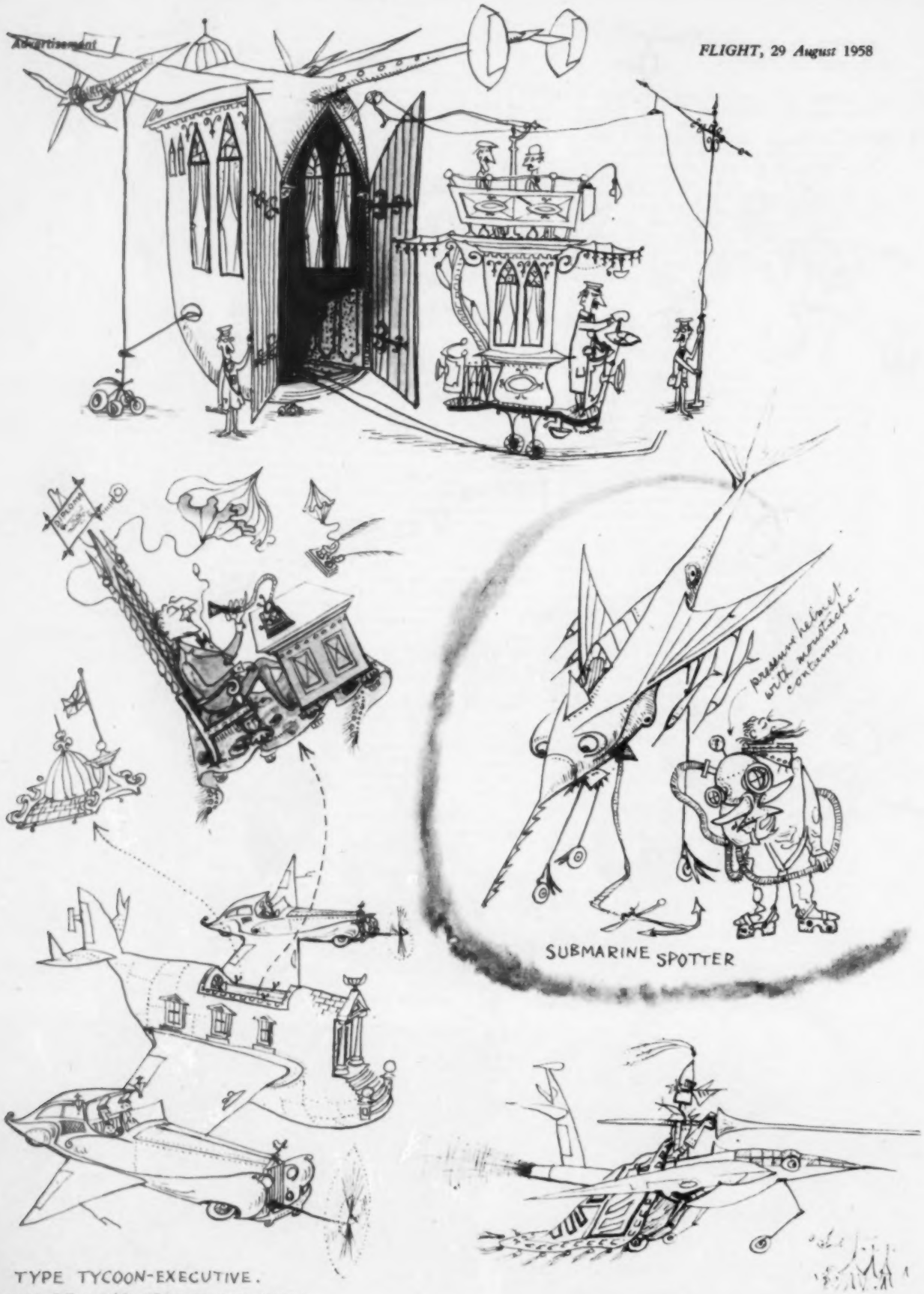
SC.1 First revealed twelve months ago, the SC.1 is Britain's first jet-powered VTOL aircraft. It was designed and built to a Ministry of Supply contract to provide an aircraft capable of conducting the basic research into the low-speed stability and control of an aircraft provided with jet powerplants for vertical lift and translational flight. Short Brothers handled all the design and development work, the autostabilization system and controls being the responsibility of the Precision Engineering Division working in conjunction with the R.A.E.

It is a tailless delta aeroplane, housing four Rolls-Royce RB.108 engines pointing downwards and a fifth RB.108 exhausting horizontally at the tail. The four lifting engines are mounted in crosswise pairs, each pair swinging on an axis so that the lifting thrust centre may be directed fore and aft on transition from vertical to forward flight and vice versa. All five units feed a compressor-bleed system which supplies air to stability nozzles under the wings and extremities of the fuselage. The nozzles are controlled by electric/hydraulic autostabilizing equipment. Other ducts supply compressed air from the thrust engine to impingement starter jets which speed up the four lift engines when the latter are to be relit before landing.

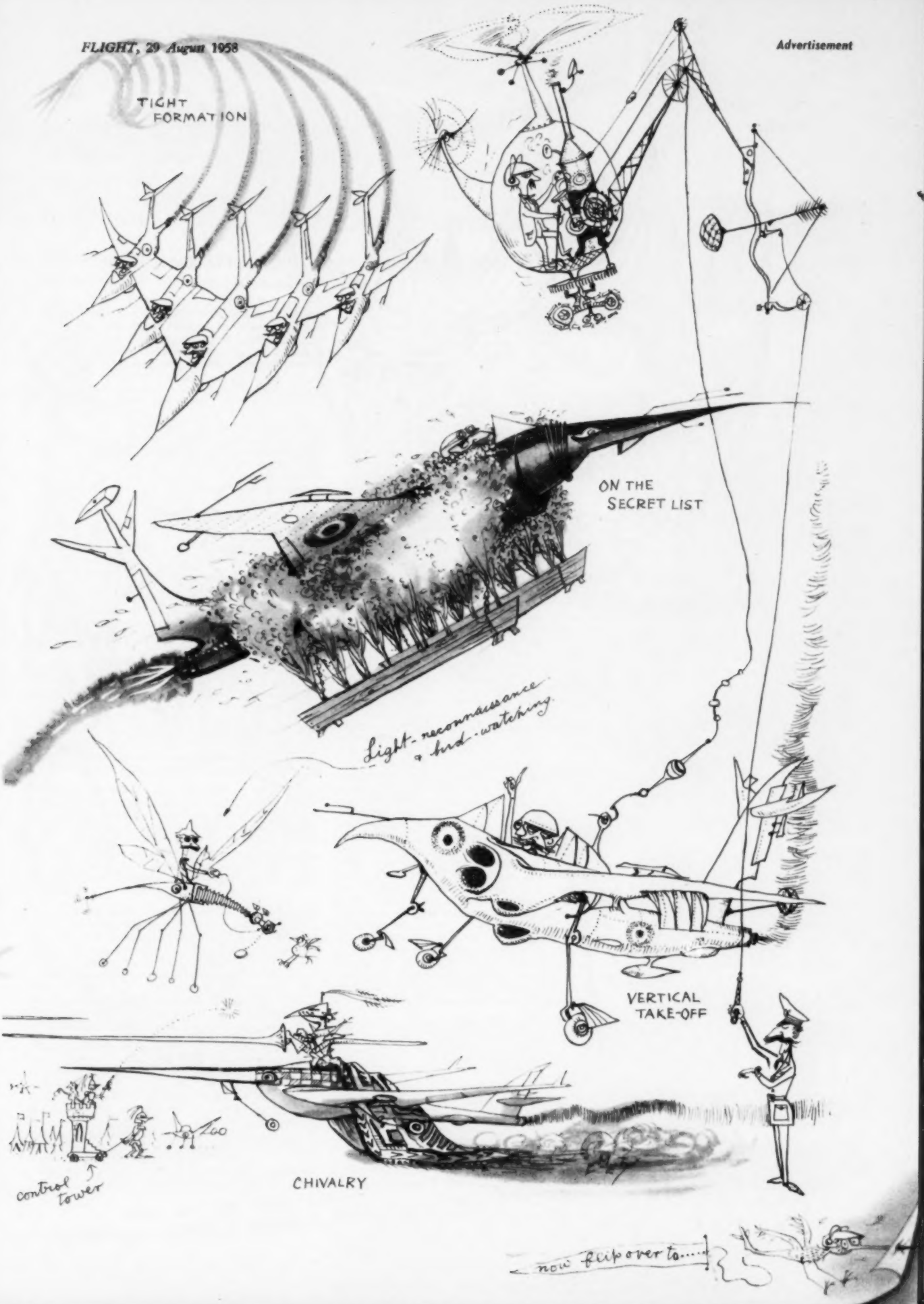
After about a year of work, the aircraft started taxying at Belfast in December 1956. Flight trials as a conventional aeroplane got under way at Boscombe Down in April 1957; tethered hovering trials began last May and free hovering started this month. When its programme is complete, the SC.1 will be capable of unrestricted vertical and horizontal flight. Pilots who have flown the SC.1 include Tom Brooke-Smith, Short's chief test pilot, and S/L. S. J. Hubbard from the R.A.E., Bedford. Mr. Brooke-Smith said earlier this month, "I am very pleased with the way the SC.1 handles. The jet lift controls and autostabilizer system have proved entirely satisfactory in these first tests, and the aircraft has always been under complete control." The research undertaken by this machine is expected to be applicable to the design of VTOL supersonic aeroplanes.

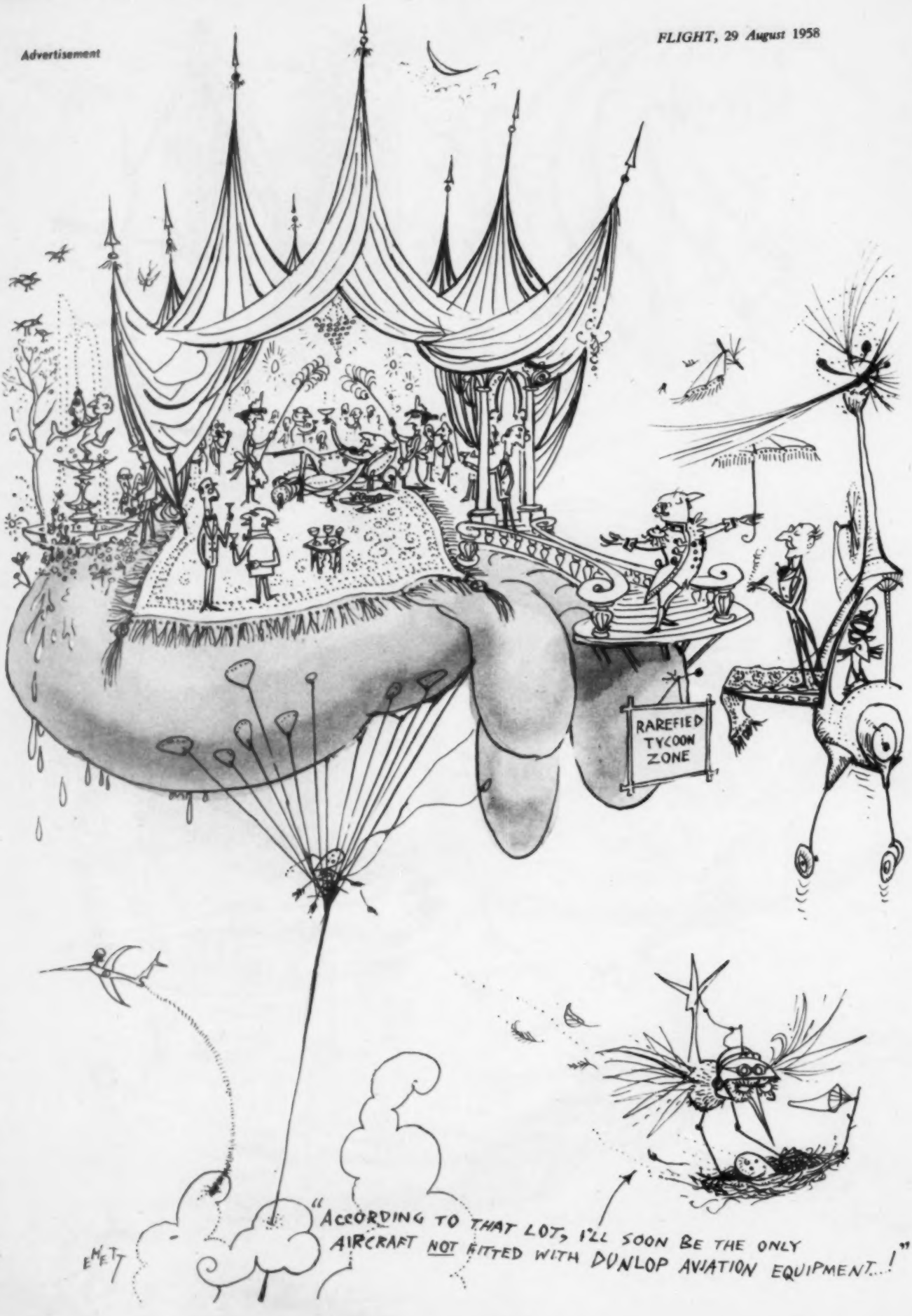



DUNLOP
AVIATION
DIVISION
present:-
farnborough
FANTASIA
by EMETT
"I'LL PRANG YOU, IF YOU KEEP ON PULLING THAT PAGE BACK..



TYPE TYCOON-EXECUTIVE.
{WITH EJECTOR SEAT-ON-THE-BOARD & ROLLS-ROYCE ENGINES.}


TIGHT FORMATION
ON THE SECRET LIST
Light-reconnaissance & bird-watching
VERTICAL TAKE-OFF
control tower
CHIVALRY
now flip over to.....


RAREFIED
TYCOON
ZONE
"ACCORDING TO THAT LOT, I'LL SOON BE THE ONLY
AIRCRAFT NOT FITTED WITH DUNLOP AVIATION EQUIPMENT...!"
EMETT

Viscount 794.

Vickers-Armstrongs (Aircraft), Ltd.

Weybridge, Surrey. Telephone: Weybridge 5555

Viscount A total of 399 Viscounts of all versions has now been ordered or delivered. The history of this aircraft—the most successful of all British transports—is sufficiently well documented to render repetition in this special number of *Flight* unnecessary. The most recent record was published in the issue of July 11 on the occasion of the tenth anniversary of the Viscount's first flight.

Here it is appropriate to summarize salient characteristics of the main variants now available. Of these the most important is the new 810 version, which entered service (with Continental Air Lines of the U.S.A.) last May. This version is the heaviest, fastest and most powerful of the breed, and is structurally designed to permit further improvements in performance and lifting capacity if required.

Viscount 700D As the suffix D indicates, this is a development of the original production 700, having more power and higher weight. Engines are Rolls-Royce Dart 510 of 1,600 s.h.p., and weights range up to 64,500 lb. Typical performance is a cruising speed of about 325 m.p.h., and ability to carry a payload of 11,800 lb to 12,250 lb for a stage distance of more than 1,400 st. miles.

Viscount 790 This is the "local-service" development, powered by the 1,400 s.h.p. of the earlier Dart 506, but offering increased seating capacity (54 to 65, compared with 44 to 53 of the 700 and 700D). This is made possible by increased cabin-length. Landing weight is also increased from 57,500 lb to 58,500 lb. These and other changes are made to give best possible seat-mile economy on the shortest stages.

Viscount 800 The aircraft of this series, which has now given place to the 810 series, represented the intermediate step between the Viscount 810 development and the Viscount 700D. With the same power as the 700D (Dart 510 of 1,600 s.h.p.) the 800 has increased capacity—up to 72 passengers—and less range, and was designed to improve the type's short haul economy.

Viscount 810 Latest member of the family, and now being delivered to other airlines beside the first 810 customer, Continental, this Viscount offers increased cruising speed—up to 370 m.p.h. —and a maximum payload increased to 13,050 lb. These improvements have been made possible (as indeed have all Viscount developments) by increased performance of the Rolls-Royce Dart. The Viscount 810 is powered by four Dart 525s of 1,800 s.h.p. each.

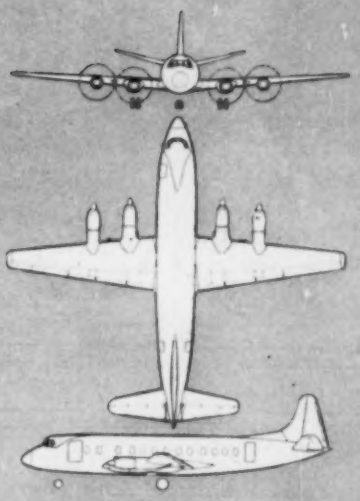
Vanguard The year 1958 is expected to see the debut of what may well prove to be the world's cheapest producer of air transport. The Vanguard sprang from B.E.A.'s requirements for an aircraft which, while offering competitive speed (up to 425 m.p.h.) and comfort, would improve to a revolutionary extent the inherent difficulty of making a profit out of short/medium-haul route networks—especially those subject to heavy "peak" problems.

The outcome of a long B.E.A.-Vickers study of these requirements was announced early in 1956, and in 1957 the Corporation placed an order for 20. In the same year Trans-Canada Airlines signed a contract for the same number.

The Vanguard represents an entirely new approach to the short/medium transport formula. Traditionally, small size (e.g., Convair or Viscount) has generally been associated with short ranges; and large size (DC-6/7, Constellation, Stratocruiser) with the long hauls. To visualize an aircraft of Stratocruiser-like size operating the world's regional and continental networks is to appreciate the formula of the Vanguard. With a maximum seating capacity of 139, and with a payload nearly thrice that of the smaller Viscount and Convair, the Vanguard offers to exploit in the most profitable way the rising traffic of the sixties and seventies. The history of air transport has shown that the most economical way of handling expanding business at a given—and, indeed, higher—frequency is to employ transports of larger capacity. By doing this the industry is able to reduce its unit costs of operation, per ton-mile or per seat-mile, and to penetrate farther into markets by passing on its lower costs in the form of lower fares. It is in this way that air transport has progressively moved towards being a mass-production industry which, in the long term, is the most profitable. The airlines have some way to get before they achieve these mass-production standards by tapping new markets, but the Vanguard is potentially the vehicle which promises to realize such standards. A unique feature of the Vanguard, aimed at ameliorating the airlines' peak-traffic problems, is the large freight capacity, which permits capacity payload to be carried with only one-quarter of the seats filled.

Vickers have recently been making significant claims for the price-cutting potentialities of their new transport. Aware of the airline industry's present pre-occupation with jets, which the company believes will not be able to match the low-cost capabilities of the Vanguard on the shorter stages, Vickers have given some examples of the kind of fare-reductions which the Vanguard will make possible. They claim that, at a 65 per cent load factor, the 139-seat Vanguard can operate at a 10 per cent clear net profit with fares ranging from 30 to 50 per cent below current tourist rates. Percentage fare-reductions actually calculated for particular routes vary from 29 per cent on a 239-mile stage to 50 per cent on a 686-mile stage.

These figures are those attainable by the new Vanguard. Early in August Vickers announced important improvements to the aircraft, including an increase in payload from 25,000 lb to 29,000 lb made possible by increased zero-fuel weight.

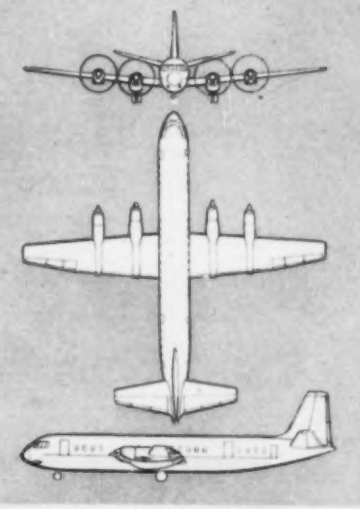


Vickers-Armstrongs Viscount 800-series (drawing above)

Powerplant	Four Rolls-Royce Dart 525
Span	93ft 8½in
Length	85ft 8in
Gross weight	69,000 lb
Cruising speed	365 m.p.h.

Vickers-Armstrongs Vanguard (drawing and artist's impression below)

Powerplant	Four Rolls-Royce Tyne 2
Span	118ft
Length	122ft 10½in
Gross weight	141,000 lb
Cruising speed	425 m.p.h.



British Aircraft 1958

Vickers-Armstrongs VC.10 (drawing above)

Powerplant	Four Rolls-Royce Conway
Span	140ft
Length	158ft
Gross weight	299,000 lb
Cruising speed	about 600 m.p.h.

VC. 10 Design-work on this important new British jet transport has progressed considerably since B.O.A.C. signed a £60m contract for 35 (with an option on 20) last February. Powered by four Rolls-Royce Conways, the 150-seat VC.10 will be Britain's contender for the big-jet class of transport market established by the Boeing 707 and the Douglas DC-8.

The Vickers design should be an improvement upon these aircraft in two important respects: the powerplant will be installed in the rear-fuselage position to confer the cleanest possible wing and the quietest passenger cabin. Notwithstanding superior field performance, it is not necessarily intended for use at airports which are unsuitable for the 707 and DC-8; by the time the VC.10 enters service in 1963-64 most trunk route airports will probably have been improved. But the VC.10's take-off performance advantage should permit fewer limitations of payload/range performance, and hence improved economy.

The market for the VC.10 should be elastic to such technical improvements, notwithstanding the fact that, by 1963, most major airlines will have equipped themselves with 707s or DC-8s. But the indications are that, in the home market, B.O.A.C. are basing their long-term planning almost exclusively upon the VC.10; and since it is an aircraft which is likely to be competitive for perhaps two decades, the initial B.O.A.C. order for 55 aircraft (including options) may well be increased substantially over the years.

Valiant Three principal variants of the Valiant, the B.1, B(PR).1 and B(PR)K.1, are now in service with seven squadrons in No. 3 Group Bomber Command. A further squadron flies B(PR).1s and B(PR)K.1s from Wyton as part of the reconnaissance force; and No. 199 Sqn. flies Valiants on special duties. Possibly over a hundred machines have been built, the last one having left the Vickers factory at Brooklands in August 1957.

The Valiant was the first V-bomber to go into service and it has established a fine reputation for performance and ease of handling. Its safety record with the R.A.F. is also almost unrivalled.

Vickers-Supermarine Scimitar F.1

Powerplant	Two late-model Rolls-Royce Avon
Span	37ft 2in
Length	56ft 2in

Vickers-Armstrongs Valiant BK.1.

A detailed description and cutaway drawing of the Valiant appeared in *Flight* for July 4, and a report of a sortie in a Valiant from Honington in *Flight* for July 19 last year. Valiants have participated in various nuclear weapon tests and have delivered nuclear weapons.

According to their identifying designations Valiants can carry conventional or nuclear weapons in the bomb bay, and bomb packs or large fuel tanks on underwing pylons, or a comprehensive series of cameras for reconnaissance or survey; and many of them are fitted for probe-and-drogue refuelling either as receivers or tankers. All marks are powered by 200-series Rolls-Royce Avons and carry a crew of five.

Scimitar Following successful Service trials of the Scimitar with No. 700X Flight, Fleet Air Arm, at R.N.A.S. Ford, production machines have been delivered to No. 803 Sqn. at Lossiemouth. This unit is now working up preparatory to going aboard H.M.S. *Victorious* in September.

Powered by two Rolls-Royce Avon 200 series engines, the Scimitar is a single-seat strike fighter capable of high subsonic speeds at sea level. To cater for the stresses of strike work the airframe is, in fact, strong enough to sustain speeds well over Mach 1 at such heights. Yet pilots report that it handles like its smaller single-seat predecessors and presents no problems. All controls are fully powered, the horizontal tail being a single slab surface having pronounced anhedral. Supercirculation is applied over the flaps using compressor-bleed air vented from spanwise slots over the top of the flaps. This is automatically applied when the flaps are lowered more than 10 deg; and it greatly reduces the safe approach speed for carrier landing.

The Scimitar has four underwing pylons on which large and small fuel tanks or various combinations of stores may be carried. Standard fixed armament consists of four Aden 30 mm guns; and the possibility of carrying Firestreak missiles for interception purposes is being studied. A reconnaissance version with a camera nose has been seen. The Scimitar can also deliver a tactical atomic bomb and carries a semi-automatic navigation system and equipment to facilitate accurate delivery over long ranges. A flight refuelling probe can also be fitted.

Carrier landing trials were completed during 1957 and Arctic trials were completed in the cold chamber at Weybridge. Lt-Cdr. D. F. Robbins took a Scimitar out to Bahrein for tropical trials late in June. He completed the first leg of the flight, direct from London to Malta, in 2 hr 12 min 27 sec at an average speed of 588 m.p.h.

The massive nosewheel undercarriage retracts its main units into the wing and fuselage and a very large arrester hook withdraws into recesses at the rear of the fuselage. A retractable tail bumper is also fitted. The flaps are continued under the fuselage by two additional flap panels; and a multi-petal airbrake system (some parts of which are liberally perforated) extend around the fuselage just aft of the wing. The leading edge of the wing droops during the approach and carries a saw-tooth extension near the curved wing tips. The centre fuselage is sharply waisted in accordance with the tenets of area rule. For carrier stowage both wings and nose fold.

Westland Aircraft, Ltd.

Yeovil, Somerset. Telephone: Yeovil 1100

Westminster The largest unsponsored venture in recent years, the Westminster is now flying after a creditably short design and construction period. The first machine is, in fact, based on a welded-steel tube space-frame which locates the fully engineered cockpit, powerplant, transmission and rotor systems so that all these can be fully flight-tested. The main fuselage configuration therefore remains quite free and can be finally decided according to orders which may be placed in the future. Nevertheless, a crane or transport version based on the space-frame may ideally suit a number of rôles, not the least important of which would be the carriage of complete missiles from storage unit to launching site. The Westminster might also be fitted with anti-submarine search and strike equipment to fit it for shore-based anti-submarine work over relatively long ranges. As a transport, the Westminster offers a cruising speed of 150 m.p.h. and a range of 100 miles with reserves at full load. A wooden mock-up constructed by Westland features some 40 seats in rows of five abreast, with vestibules, luggage racks and entrance doors at either end. Since the first flight on June 15, well over 7 hr have been flown and the machine has given full satisfaction.

The Westminster is based on the five-blade main rotor and reduction gear of the Sikorsky S-56; and it has the same tail rotor system and tailwheel. In contrast to the S-56, however, the engines are mounted side by side above the cabin and they are, of course, turbines—Napier Eland 229s with fixed-shaft drives. In theory the Westminster powerplant is a constant-speed system in which variations in load caused by pitch-changes in the rotors provide a power demand to the engines. Change in load causes a change in r.p.m. which is immediately sensed by a governor on each engine. Fuel input is then adjusted to maintain constant speed. But, with two fixed-shaft engines driving into a single rotor shaft, any difference in power output between the two engines would cause divergent load-shedding. Freewheels in each transmission would in any case isolate the drive of the lagging engine. To allow for the characteristics of each individual engine and to accommodate slight speed variations on which the governors rely for their signals, a hydraulic clutch has been interposed in each transmission. A constant 2 per cent slip in these clutches provides the necessary flexibility.

Each governor has a variable datum controlled from levers on the centre console of the cockpit, so that various speeds can be selected to suit different régimes such as take-off, cruise and idling. If each engine is producing 1,500 h.p. to provide a total of 3,000 h.p. at the rotor, any power reduction in one engine is immediately sensed and compensated for by an increase in fuel flow to the "good" engine; and as this is already running at high r.p.m., it can supply the additional power without any time lag and, particularly, without any special action on the part of the pilot.

A second Westminster with a space-frame fuselage is now under construction and it will have Elands delivering 3,500 s.h.p. each. The power of a single engine will then be sufficient for flying at slow speeds near the hover.

Westminster flying controls are fully powered and have duplicated hydraulic supplies at 3,000 lb/sq in. One hydraulic pump is driven from the main rotor gearbox and the other by the port engine. The fuel system consists of two 250 Imp. gal tanks mounted within the space-frame, with electric booster pumps supplying a collector tank from which further pumps raise fuel to the engines. Alternatively compressor-bleed air can be used to pressurize the tanks for emergency fuel transfer. The streamlined cockpit provides accommodation for a crew of two with full blind flying instrumentation and night-flying facilities. Since engine power is controlled by the governors there is no need for a throttle twist-grip on the collective-pitch lever. An autopilot will be fitted to production machines. A detailed description and cutaway drawing of the Westminster appeared in *Flight* for August 15.

Whirlwind Both civil and military versions of this machine are now in production; and both are powered by the Alvis Leonides Major engine derated to give 750 h.p. The civil machine, known as the Mk 5, can carry up to ten passengers or freight loads of as much as a ton. Fittings are available for special rôles such as ambulance flying, and winching or carrying loads externally.

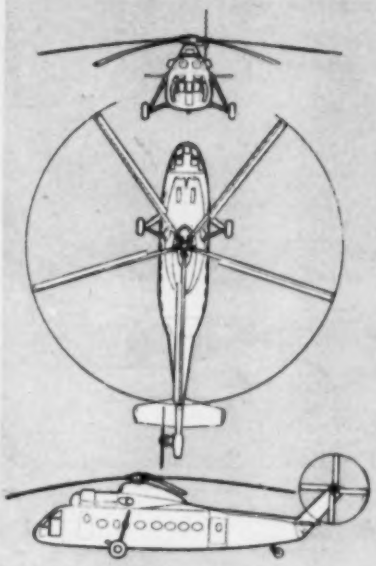
The military Whirlwind is the HAS.7, supplied to the Fleet Air Arm for anti-submarine duties. In this version it can carry detection equipment and a homing torpedo slung in a trough beneath the cabin. Its use in service was described in *Flight* for May 2.

Wessex Production of a considerable number of Wessexes for the Royal Navy is now under way at Yeovil, the first production machine having flown some five months ahead of schedule. By virtue of the fact that the Wessex is constructed to A.R.B. specifications it will at a later date be able to obtain a full civil certificate of airworthiness and civil sales are then confidently expected.

Westland began the Wessex project by converting a Sikorsky-built S-58 to take an early Napier

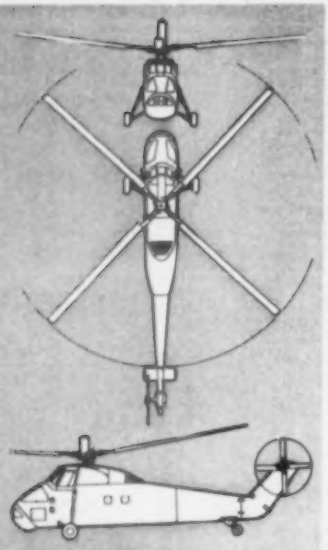
Westland Westminster (crane version photograph above; drawing below shows passenger version, figures for which are given in parentheses)

Powerplant	Two Napier Eland 229
Rotor diameter	72ft
Length	86ft 9in
Gross weight ...	36,000 lb (33,000)
Cruising speed	115 m.p.h. (150 m.p.h.)



Westland Whirlwind Mk 7 (photograph below)

Powerplant	Alvis Leonides Major 151/155
Rotor diameter	53ft
Fuselage length	42ft 4in
Gross weight (overload) ...	8,400 lb
Cruising speed	99 m.p.h

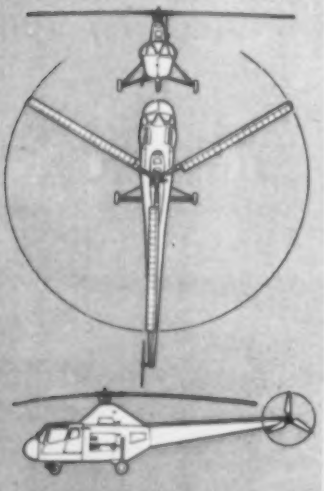


Westland Wessex (drawing and photograph above)

Powerplant	Napier Gazelle NGa.13
Rotor diameter	56ft
Fuselage length	49ft 11in
Gross weight	12,600 lb
Maximum speed	144 m.p.h.

Westland Widgeon (drawing and photograph below)

Powerplant ...	Alvis Leonides 521
Rotor diameter	49ft 2in
Fuselage length	41ft 3in
Gross weight	5,900 lb
Cruising speed	91 m.p.h.



Gazelle NGa.11 free-turbine engine delivering 1,120 s.h.p. This conversion worked extremely well and production machines have the NGa.13 which delivers 1,450 s.h.p. and has an automatic acceleration control. Though this power is still less than the 1,525 s.h.p. delivered by the originally fitted Wright Cyclone, the absence of cooling fans and clutch and the greatly reduced weight of the Gazelle have led to a performance rather better than that of the S-58. The Gazelle installation is, in fact, some 600 lb lighter than that of the piston engine; and the operations of installation and removal are very simple and quick. Fuel tankage is disposed in two groups of bag tanks located underneath and immediately in front of the main cabin, a total of 270 Imp. gal being carried. In addition an extra 30-gal tank can be added to the rear group and external drop tanks can be carried on crutches either side of the cabin. The maximum disposable load, including fuel and crew, is 5,000 lb, allowing carriage of more than 20 troops.

The Gazelle drives through its own reduction gear, via a freewheel, directly to the main rotor reduction gearbox, producing a rotor speed of 222 r.p.m. for an engine speed of 17,000 r.p.m. The tail rotor is driven from the main gearbox at 1,318 r.p.m. Further drives on the main gearbox are provided to serve the gearbox oil-cooler fan, two hydraulic pumps providing separate supplies for the power-operated flying controls and hoist, an oil pump, a 12 kW generator and its cooling fan and the rotor-head tachometer. The rotor itself is a standard S-58 unit having four blades and capable of being operated in winds of up to 50 kt. The starting cycle is very rapid, neither warm-up time nor clutch-engagement being required. The Wessex can therefore be airborne less than 30 sec after the starter button is pressed.

The spacious cabin, measuring 13ft 6in long by 5ft 3in wide, has 6ft headroom throughout. It is entered by a large sliding door on the starboard side above which the hydraulic 600 lb winch is mounted. The crew of two can reach the flight deck either through hatches in the front of the cabin or by climbing up the side of the fuselage and in through the cockpit side windows. For carrier stowage the tail and rotor blades of the Wessex can be folded to reduce its overall length by no less than 27ft 4in. The tailwheel undercarriage makes taxying very easy.

Because the Gazelle powerplant weighs some 600 lb less than its piston-engine predecessor, a good deal of equipment has been moved to the forward end of the aircraft. This includes much of the electrical gear which is stowed on racks accessible by opening a car-type bonnet lid over the nose. While doing this the groundcrew can stand on a strengthened hinged panel which also provides access to the engine itself. This is enclosed within a steel fireproof shrouding; and the intake is arranged as a wire mesh grill with internal baffles in the extreme nose.

Artificial-feel springs are applied to the Wessex flying controls; and Lear gyro and amplifying components will be incorporated to provide autostabilization and manœuvre control. This system will maintain the helicopter on a given heading and control its height according to barometric-capsule indications. In Naval service the Wessex will burn the standard Naval turbine fuel, Avcat; and B.T.H. iso-propyl nitrate starting will be used. As an ambulance the Wessex can carry eight stretchers, while in civil service it will carry twelve passengers, baggage and a crew of two. A notable asset of the Wessex is its extreme quietness of operation. A detailed description and cutaway drawing of the Wessex appeared in *Flight* for November 29, 1957.

Widgeon This is Westland's own development of the earlier Dragonfly. The engine is still an Alvis Leonides, but a Whirlwind rotor is fitted affording a much greater permissible c.g. travel. The cabin section has also been completely redesigned and now provides accommodation for five people or freight. Two stretchers may be loaded by opening the port half of the nose cone and shifting the front passenger seat to the rear right position for the use of a doctor or attendant. A hydraulic winch capable of lifting two people at a time can be mounted to starboard; and V.I.P. furnishings can be supplied if required. A number of Widgeons have been sold to operators in various parts of the world and to the Brazilian Navy.

British Aircraft 1958

Sailplanes

Elliotts of Newbury, Ltd.

Albert Works, Newbury, Berks.
Telephone: Newbury 312.

TWO new types in the Olympia 4 series made their first flights earlier this year—the 19-metre Olympia 419 and its 15-metre variant, the 415—and both were flown in the World Gliding Championships at Leszno, Poland. The subject of a cutaway drawing and description in our issue of June 13, 1958, the 419 is perhaps the highest-performance British-designed sailplane built to date. Of the two which have been completed, the prototype is owned by Elliotts and the second machine has been purchased by the R.A.F. Gliding and Soaring Association. A batch of 12 further 419s is being produced at a selling price of £2,150 per aircraft. No further manufacture of the 415 is contemplated.

Other current work at Newbury includes the assembly of 24 further Olympia 2s, of which an initial batch of 100 formed the immediately post-war backbone of high-performance gliding at British gliding clubs. The current batch of Olympia 2s should still prove attractive to clubs and private owners at a basic cost of £800 apiece. The first four of these aircraft are for Pakistan and the R.A.F.G.S.A. has ordered nine.

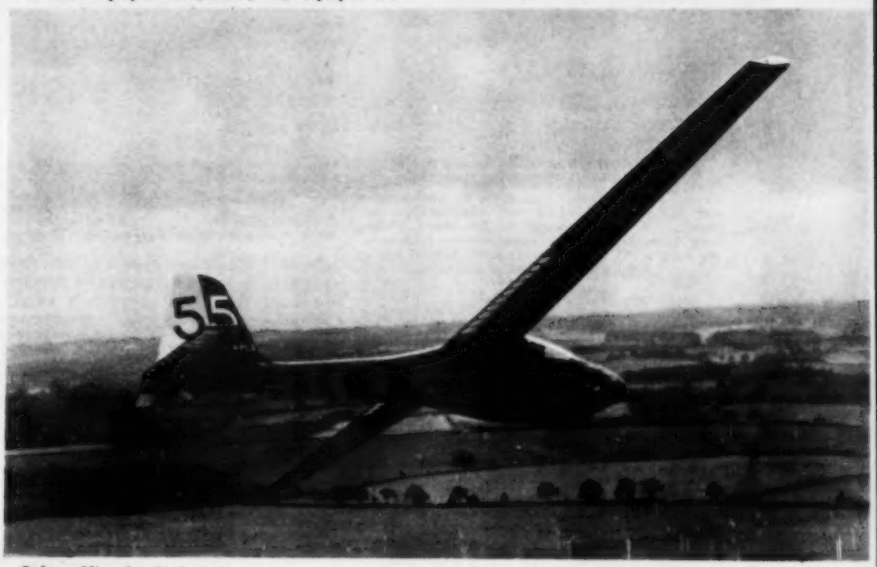
Elliotts Olympia 419 (above) and Olympia 415.

Slingsby Sailplanes, Ltd.

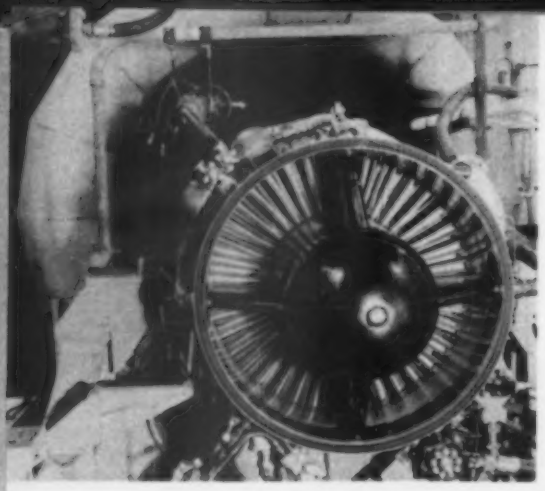
Kirbymoorside, Yorkshire.
Telephone: Kirbymoorside 312.

THE Kirbymoorside factory of F. N. Slingsby continues to be as busy as ever, with five types currently in production. These are the Skylark 2, Skylark 3, T.21B, T.42B Eagle, and Swallow. The most recent of these is the Swallow, designed as a poor man's Skylark—a single-seater that is simple and cheap, yet having a useful performance. Slingsby's design philosophy in this has been to concentrate on providing an aerodynamically efficient wing, with a rudimentary fuselage. Of the two aircraft completed to date, one is being demonstrated at various U.K. gliding clubs and the other has been exported. Selling price of the Swallow, eight of which are being built as an initial batch, is £750.

A unique distinction for an off-the-peg Slingsby sailplane was the achievement of Commander Nicholas Goodhart and his own Skylark 3 in gaining second place in the open class of the World Gliding Championships in Poland, in competition with many more-recent and more-expensive aircraft. The Skylark 2 is the 15-metre predecessor of the Mk 3 and one of this type was also an entrant at Leszno. Few newcomers to gliding in recent years have received their initial instruction on anything other than the ubiquitous T.21B (known as the Sedbergh by the R.A.F. and A.T.C.), while about twelve of the advanced T.42B Eagle two-seaters, winner of the two-seater class in the 1956 World Championships, are now in private-owner and syndicate hands in this country. In addition several examples of this machine, which costs £1,650, have been exported.



Below, Slingsby Skylark 3.



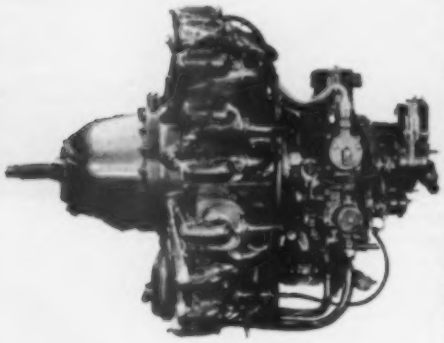
British Aero Engines 1958

ALVIS, LTD.

Holyhead Road, Coventry
Telephone: Coventry 25501

Leonides For many years this very attractive single-row radial engine has been in production for fixed-wing aircraft and helicopters. Total flight time is of the order of two million hours, most of which has been logged under arduous conditions; several hundred Leonides are used by Hunting Provosts of various air forces and the engine is also fitted to the Pembroke and President, Dragonfly, Widgeon and Sycamore. Most production deliveries are currently going into Twin Pioneers, and it is partly to satisfy a demand for greater take-off power for this aircraft that a new longer-stroke version has been developed.

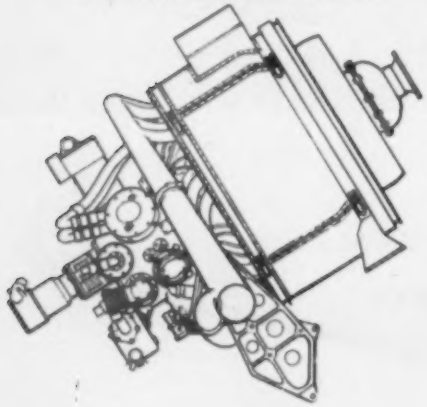
Known as the 530-series, the long-stroke family is a company venture which has already completed a considerable amount of bench running. The first 530s have a standard rear cover and will comfortably deliver a sea-level power of 600 h.p. Later engines will have a revised rear section incorporating a supercharger of increased capacity which will enable altitude performance to be substantially increased.



Alvis Leonides 503/4. Piston engine for fixed-wing aircraft. Nine-cylinder, poppet-valve, supercharged and geared radial engine with injection-type carburettor. Overall diameter, 41.5in; length, 54.4in; bore, 4.8in; stroke, 4.41in; swept volume, 718.6 cu in; dry weight, 795 lb; maximum rating, 520/540 h.p. at 3,000 r.p.m. with boost of 8 lb/sq in.

Leonides Major This powerplant has fourteen Leonides-size cylinders arranged in two staggered rows. Like its forerunner it has been developed in both aeroplane and helicopter versions, the latter being a direct-drive unit equipped with a cooling fan. The fixed-wing Major has completed a great deal of flying and can be regarded as a highly developed unit. Emphasis has, however, been focussed upon the helicopter engines, and these are in production and wide service in the Mk 5 and Mk 7 Whirlwinds. The unit illustrated has a single-speed supercharger, an injection-type carburettor and a cartridge starter.

Alvis Leonides Major 151. Helicopter engine. Two-row 14-cylinder piston engine mounted in the Whirlwind at 35 deg with supercharger and direct drive with cooling fan. Overall diameter, 38.9in (basic engine); length as shown, 54.86in; bore, 4.8in; stroke, 4.41in; swept volume, 1,118 cu in; dry weight, 1,050 lb; one-hour rating, 860 h.p. at 1,000ft at 2,900 r.p.m. with 9 lb/sq in boost; weak-mixture rating, 580 h.p. at 9,000ft at 2,750 r.p.m. with 2 lb/sq in boost.



BLACKBURN AND GENERAL AIRCRAFT, LTD.

Brough, East Yorks
Telephone: Brough 121

Palas Blackburn hold a licence from the French Société Turboméca to develop and produce the latter company's small gas-turbines up to a specified maximum mass-flow. The basic gas-producer has been much modified by Blackburn, as outlined in our issue of June 3, 1955. The simplest engine, in which the output is expelled as a propulsive jet, is the Palas, rated at 330 lb thrust. It is used in the Somers-Kendall S.K.1 and Miles Sparrowjet, and is optional for the Student.

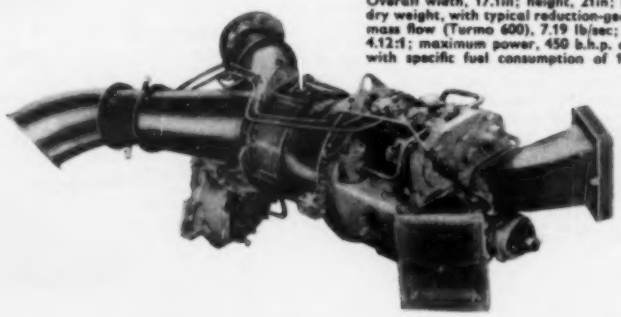
Palouste In this unit an oversize centrifugal compressor is fitted and the excess air is bled off from a manifold surrounding the combustion chamber. The current production engine, which powers the Fairey Ultra-Light helicopter, gives an air output of 2.725 lb/sec at 41.55 lb/sq in gauge pressure for a consumption of 310 lb/hr. Under development are compound versions giving delivery at 75 lb/sq in and, later, even higher pressures.

Turmo In the Turmo a free output turbine is added at the rear, giving a shaft drive which, with suitable reduction, can power either fixed-wing aircraft or helicopters. The Turmo powers the Saro P.531 Mk 1 helicopter; twin Turmos are fitted to the American Kaman K-600 and a single Turmo drives an air compressor which feeds the tip-drive nozzles of the Kaman K-17.

Artouste This is a turboshaft engine essentially similar to the Turmo but without a free output turbine. Several types of Artouste are in production for airborne auxiliary powerplants and the engine may also be used to drive fixed-wing aircraft or helicopters.

A.129 This very important new engine was described in our issue of March 21 last. Basically it can be considered as a Turmo provided with an additional turbine stage and two zero-stages of transonic axial compressor blading. With a reduction gearbox the A.129 is expected to weigh about 100 lb more than a Turmo, at 390 lb; the power, however, is likely to be as high as 950 s.h.p. when operating at maximum r.p.m., the pressure ratio being 6.35 and the specific consumption about 0.66. The first A.129 is shortly to start bench-running.

Blackburn Turmo. Turboshaft engine. Single, single-sided centrifugal compressor, annular combustion chamber with rotating fuel-injection nozzles, and single-stage turbine. Additional turbine stage added at rear and driving reduction gear to output coupling. Overall width, 17.1in; height, 21in; length, 46.12in; dry weight, with typical reduction-gear ratio, 281 lb; mass flow (Turmo 600), 7.19 lb/sec; pressure ratio, 4.12:1; maximum power, 450 b.h.p. at 36,000 r.p.m. with specific fuel consumption of 1.04 lb/hr/b.h.p.



BRISTOL-SIDDELEY ENGINES, LTD.

A technical and commercial alliance of Bristol Aero-Engines and Armstrong Siddeley Motors (below, and next page).

ARMSTRONG SIDDELEY MOTORS, LTD.

Parkside, Coventry
Telephone: Coventry 62666

P.181/182 This entirely new family of powerplants is being developed to provide optimum 1,000 h.p. units for rotary-wing aircraft (P.181) and aeroplanes (P.182). Both types of engine utilize the same compressor, combustion chamber and turbine, differences being confined to the reduction gearbox and final drive.

The compressor comprises two subsonic axial stages followed by a single centrifugal stage, with an overall pressure ratio of 5.9:1 at 20,000 r.p.m. The combustion chamber is an annular assembly, folded back around the turbine to increase safety and reduce length and employing Armstrong Siddeley vaporizing burners. A two-stage turbine drives the compressor and an independent single-stage power turbine drives the rotor or propeller gearbox, the latter (in the P.182) being at the front and driven through a central shaft. Beneath the compressor casing is the accessory gearbox, driven at 0.25 compressor r.p.m. The oil tank is cast integral with the upper half of the compressor casing, the system having a flood feed (750 Imp. gal/hr) and being fully scavenged. An electric or i.p.n. starter can be fitted, and de-icing is effected by air bleed (P.181) or by both hot air and electric means (P.182).

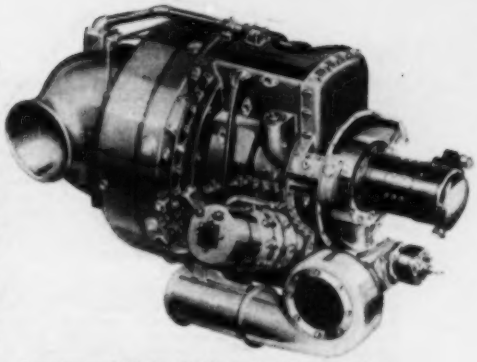
Throughout the design Armstrong Siddeley have satisfied the need for robustness, safety, simplicity and compact dimensions. The P.181, which can provide front or rear drive, will probably be completed first.

Sapphire Production of Sapphires at the large factory at Brockworth, Glos., has long been concentrated upon the advanced 200-series "second-generation" engines. These Sapphires, rated at 11,000 lb dry or 12,300 lb with reheat, are doubtless in full service with the Victor B.1 and with certain marks of Javelin. They offer a combination of high thrust, low weight, good specific consumption and great reliability, and their equipment includes thermal anti-icing, turbostarter, a high-pressure fuel/oil heat exchanger and high-energy ignition. A full description of the 200-series appeared in our issue of November 9, 1956. The reheat system is simple; making use of the excess fuel available from the main fuel pump at altitude, it can be brought into operation at all heights above 20,000ft and is associated with a two-position nozzle. The reheat engine (illustrated) is fitted to the Javelin FAW.8.

Earlier 100-series engines are widely used in Hunters and Javelins, and over 10,000 have been licence-produced, in an Americanized form, by the Wright Aeronautical division of Curtiss-Wright. These earlier Sapphires have ratings between 8,000 and 8,800 lb.

Viper Originally produced as a highly rated unit for target drones, the Viper is today in full production as a family of small turbojets for all kinds of aircraft and missile applications. The basic short-life Viper is widely used as the powerplant of the Jindivik 2 target, and a related type of engine has been used during flight trials of the U.S. Air Force's XSM-75 Bull Goose multi-purpose and diversionary missile. The 1,750 lb-thrust ASV.8 is the standard powerplant of the Hunting Jet Provost basic trainer, and has also been chosen for such machines as the Macchi MB.326, twin-engined Ikarus (Yugoslavia) fighter, Saunders-Roe SR.53 and the Bell X-14 VTOL aircraft. Dassault (France) are licence-producing derivatives, and British and French Vipers have flown at high speeds and altitudes in the Trident and Mirage I.

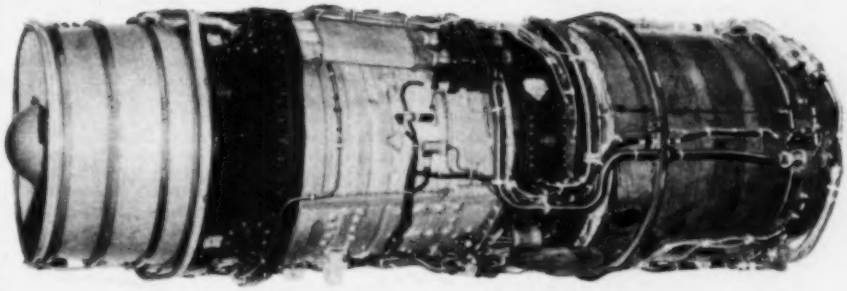
Armstrong Siddeley have now produced a new series of Vipers, in which design-changes bringing the engine into line with the latest Sapphire techniques have been coupled with an increase in mass-flow from 32 to 42 lb/sec. As a result the new Vipers are considerably more powerful than their predecessors, and their modest flame temperature promises to endow them with a long life. First of the new family to complete its 150-hr test is the ASV.11, of 2,460 lb thrust, which is earmarked for an advanced version of the Jindivik. A de-rated version is the cool-running ASV.10, of 2,000 lb thrust, intended for trainer and executive machines.



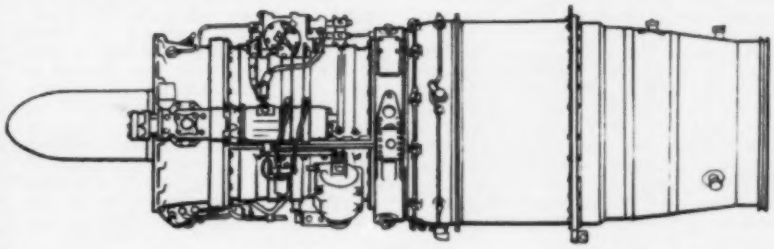
Armstrong Siddeley P.181. Turboshaft engine for helicopters. Compressor with two axial stages followed by one centrifugal stage, annular reverse-flow combustion chamber, two-stage compressor-turbine and single-stage free power turbine. Overall diameter, 27.4in; length as depicted, 60in; dry weight, 550 lb; mass flow, 12.5 lb/sec; pressure ratio, 5.91:1; maximum rating, 1,020 s.h.p. (200 lb residual jet thrust) at 20,000 compressor r.p.m. with s.f.c. of 0.71.

Double Mamba This engine comprises two independent power sections each driving its own half of a double co-axial propeller, so that either half of the engine can shut down separately. The current production model is the ASMD.8, for various late-mark Gannets; earlier Gannet powerplants are in widespread service.

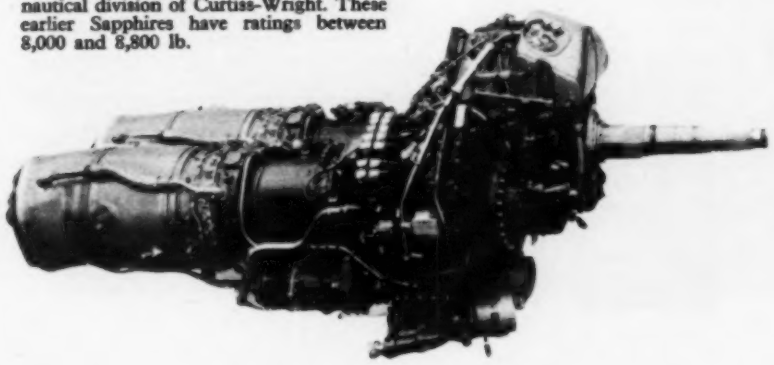
Rocket Motors No information may at present be published concerning current activity in this field. Previously the company developed two fully controllable units for piloted aircraft, using liquid oxygen and kerosine as propellants.



Armstrong Siddeley Sapphire ASSa.7R. Turbojet with inbuilt reheat system (afterburner). Thirteen-stage compressor, annular combustion chamber and two-stage turbine, simple reheat jet-pipe with variable-area nozzle. Overall diameter, 37.4in; length as depicted, 180in; dry weight, 3,180 lb complete; mass flow and pressure ratio restricted; maximum rating, 12,300 lb with s.f.c. of 1.2 (11,000 lb without reheat with s.f.c. of 0.88).

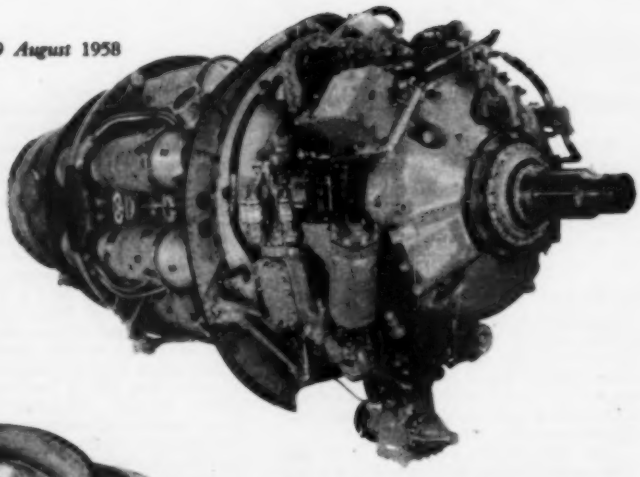


Armstrong Siddeley Viper ASV.11. Single-shaft turbojet for unmanned application. Seven-stage compressor, annular combustion chamber with 12 vaporizing burners and single-stage turbine. Maximum diameter, 28in; overall length, 69.2in; mass flow, 42 lb/sec; pressure ratio, 4:1; dry weight, 500 lb; max. thrust, 2,460 lb at 13,400 r.p.m. with s.f.c. of 1.1.



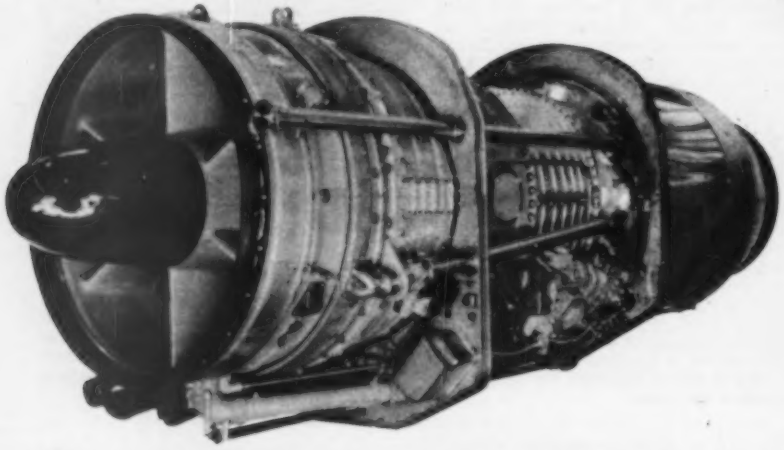
Armstrong Siddeley Double Mamba ASMD.8. Double turboprop. Two mechanically independent power sections, each driving one unit of twin co-axial propellers; each power section comprises a Mamba 8, with 11-stage compressor, annular vaporizing combustion chamber and three-stage turbine. Overall width, 56.55in; height, as shown, 45.28in; length, 109.7in; maximum rating, 1,800 s.h.p. plus 300 lb-thrust per side, a total of 3,850 s.h.p. All other data restricted. This engine is cleared for diesel fuel.

British Engines 1958 . . .



Bristol Proteus 765. Free-turbine turboprop for transports. Compressor with 12 reverse-flow axial stages and one centrifugal stage, eight combustion chambers and four-stage turbine (two pairs of stages each driving the compressor and reduction gear). Overall diameter, 40.1in; length as shown, 100.6in; dry weight, 2,900 lb; mass flow, 47 lb/sec; pressure ratio, 7.2:1; maximum rating, 4,445 e.h.p. (3,960 s.h.p.+1,260 lb) at 12,000 compressor r.p.m. with s.f.c. of 0.6; typical cruising s.f.c., 0.486.

Bristol Olympus 301. Two-spool turbojet. Inspection shows that there is a five-stage low-pressure compressor, a seven-stage high-pressure compressor, a can-annular combustion chamber with eight flame-tubes and independent single-stage high- and low-pressure turbines. Overall diameter, 41.75in; length as depicted, 126.4in; type-tested dry thrust, 17,000 lb; other data restricted.



BRISTOL AERO-ENGINES, LTD.
Filton, Bristol
Telephone: Filton 3871

Olympus First run in 1950 as a 9,140 lb-thrust turbojet, the latest member of the great Olympus family has been officially type-tested at a dry thrust of 17,000 lb, and has a minimum guaranteed thrust of 16,650 lb without any form of reheat or power boosting. The Olympus was Britain's first two-spool (split-compressor) engine, and its response to rough handling up to altitudes as high as bomber aircraft can reach is of a wholly exceptional order. An extensive article in our issue of March 7 last revealed some aspects of the superb performance of the first-generation 100-series engines in Bomber Command as the powerplant of the Vulcan B.1, and noted that the record of these military engines would do credit to a transport powerplant.

First production Olympus was the 101, of 11,000 lb dry thrust, and later models were the 102 (12,000 lb) and 104 (13,000 lb). The later 200-series, now in production for the Vulcan B.2, have a higher mass flow than earlier engines, although increased work-per-stage has permitted a reduction in the length of the compressor and prevented any increase in weight. A commercial derivative is the 550-series, of which an Americanized example is the Curtiss-Wright TJ-38 Zephyr. The 200-series is also being developed with reheat.

Orpheus Unlike other Bristol gas turbines, the Orpheus is an eminently simple single-shaft engine, and it is probably the most attractive turbojet in the world in the 5,000 lb class. Originally planned for specialized military functions, it is today being produced for supersonic fighters, trainers, transport aircraft and executive machines.

Many novel mechanical design features —such as the mounting of the turbine nozzles in the delivery segment from each combustion-chamber can, and the single-point suspension of the latter from the fuel injectors—have rendered the Orpheus a most competitive engine from the standpoints of first cost, overhaul man-hours and general reliability. Licences to produce the Orpheus have been granted to Fiat (Italy), SNECMA (France), Hindustan (India) and Curtiss-Wright (U.S.A.) and the engine has also been bought by many other countries. Flight development is taking place with engines mounted in an Ashton and Sabre, and Orpheus are also flying in such diverse production applications as the Gnat, Jetstar, Fuji TIF-2, G.91, Etendard VI and Taon. The engine shown is typical of current units, although the later BOr.12 will be rated at 6,810 lb dry or over 8,000 lb with reheat. Curtiss-Wright have developed the Americanized TJ-37 version for such aircraft as the Jetstar.

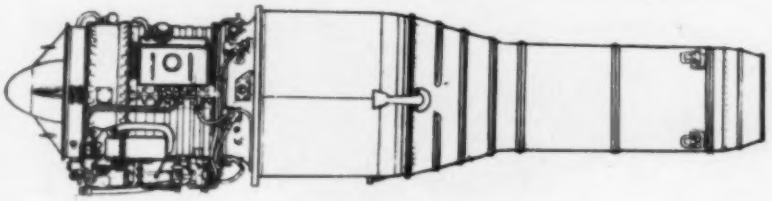
Proteus When the Britannia 102 went into scheduled service with B.O.A.C. in February last year the Proteus was the most powerful airline engine in the world, at 3,900 e.h.p. This palm has now passed to the Soviet AM-3 turbojet, but the Proteus can still claim to have the lowest cost per ton-mile of any airline engine, as well as exceptionally good reliability. In the period since its entry to service the overhaul life of the Proteus 705 has been progressively raised to 1,600 hr, and B.O.A.C. are running trial engines to 1,900 hr.

The next mark to be produced was the 755, in which detail design improvements raised the take-off e.h.p. to 4,120 (this is the brochure figure, although B.O.A.C.'s mean fleet power is rather higher, at 4,160 e.h.p.). Still later improvements have led to the current marks, of which the 765 is the most important. The 255 is a slightly different military engine for the Transport Command Britannia 253s, with water injection.

Ramjets Bristol Aero-Engines' experience of complete supersonic ramjet powerplants is almost certainly unmatched outside the U.S.A. The first production engine is the Thor, a 15.75in-diameter unit with a circular intake housing a double-shock fixed centre-body, a ram-driven turbine fuel pump and giving an equivalent sea-level horse-power of about 130,000 at Mach 3. Thors have become as reliable as any ramjet in the world, and a very large number are being made for the twin-engined Bloodhound missile.

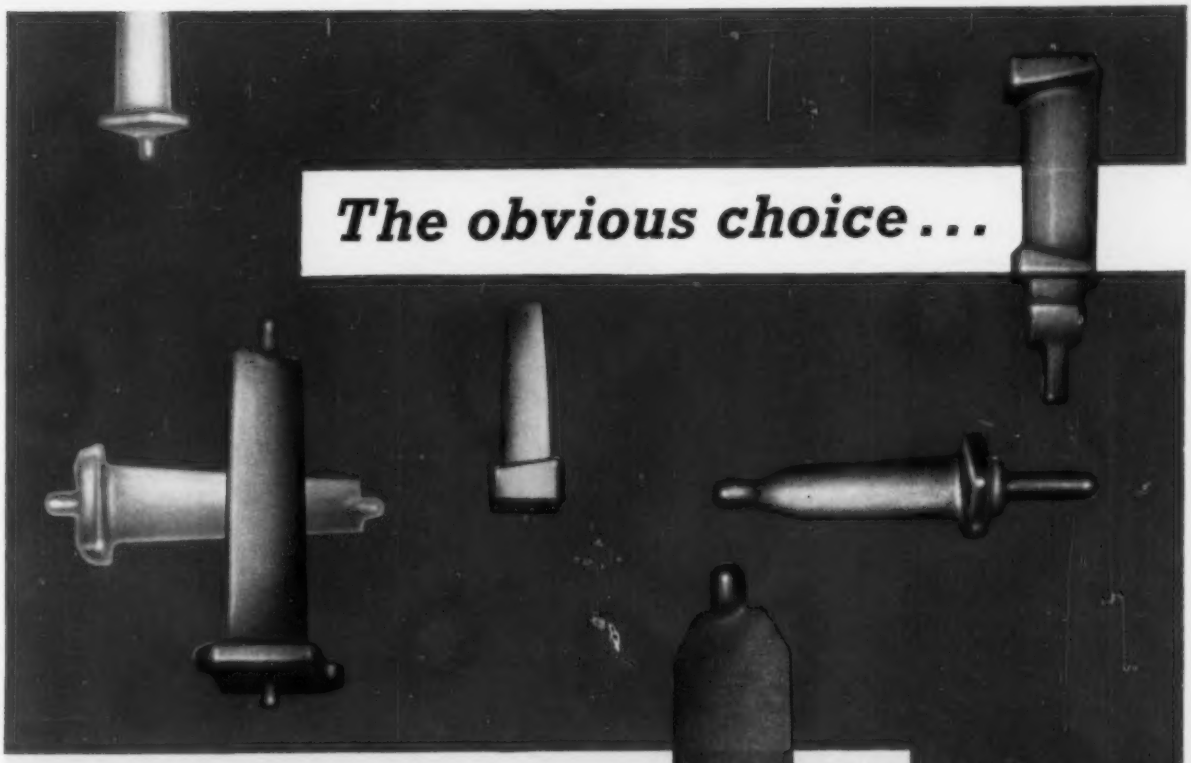
Last year the company displayed the BRJ.801, an 18in engine with a power output which is obviously far greater than the additional two inches of diameter

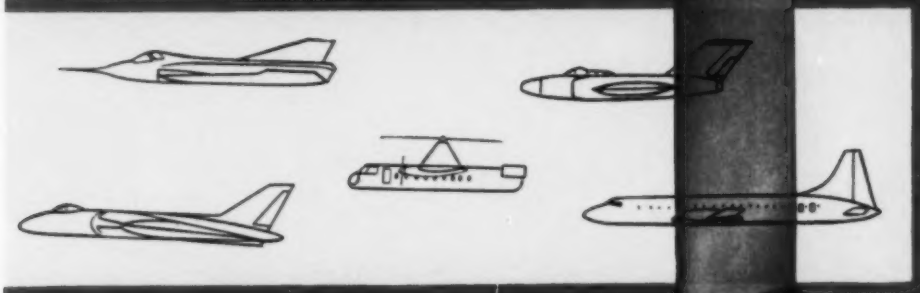
Bristol Thor BT.1. Supersonic ramjet for propulsion of the Bloodhound surface-to-air missile. Double-shock intake, ram-driven fuel turbopump feeding annular injection manifold and convergent/divergent fixed-geometry nozzle. Overall diameter, 15.75in; length, 94.5in; approximate equivalent horse-power, 130,000 at Mach 3 at sea-level; all other data are restricted.

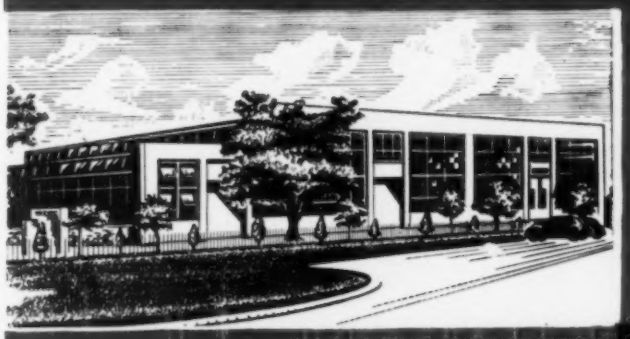


Bristol Orpheus BOr.3 (Series 803). Single-shaft turbojet. Seven-stage compressor, annular combustion chamber with seven burners and single-stage turbine. Overall diameter 32.4in; length as shown (with jet pipe), 150in; dry weight, about 825 lb; mass flow and pressure ratio, restricted; maximum thrust, 4,850 lb, with s.f.c. of 1.06. The Orpheus shown is equipped for the Fiat G.91.

The obvious choice...







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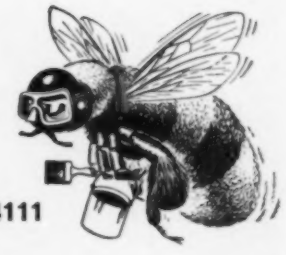

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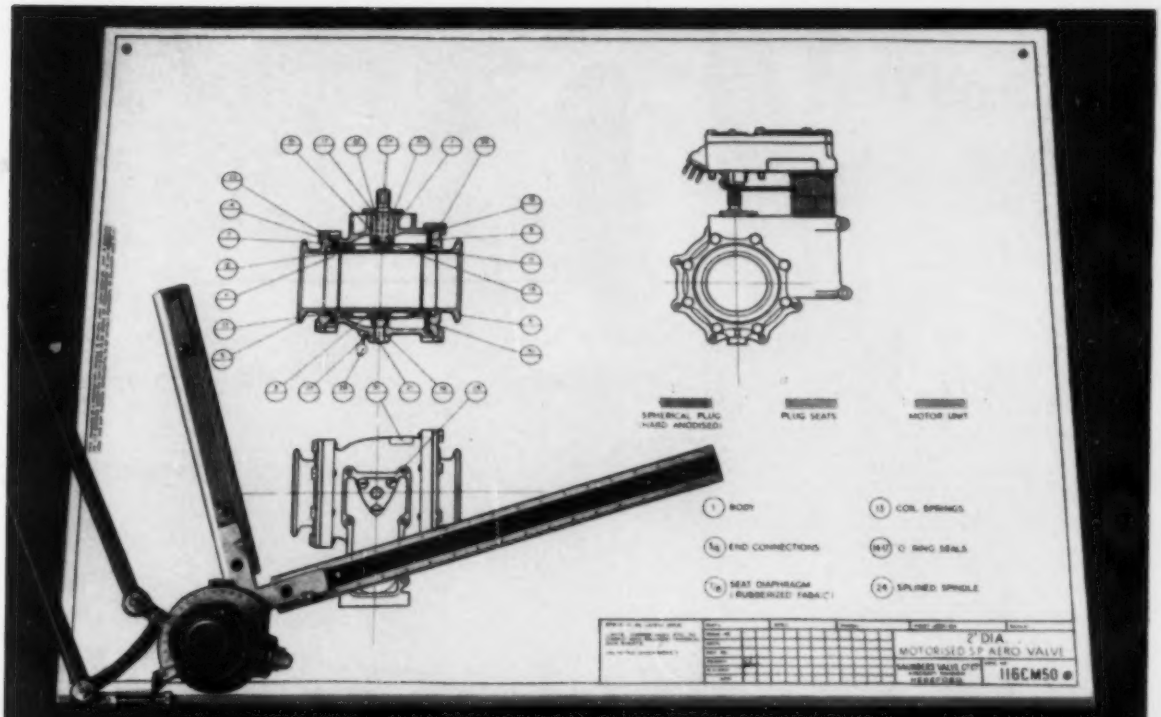

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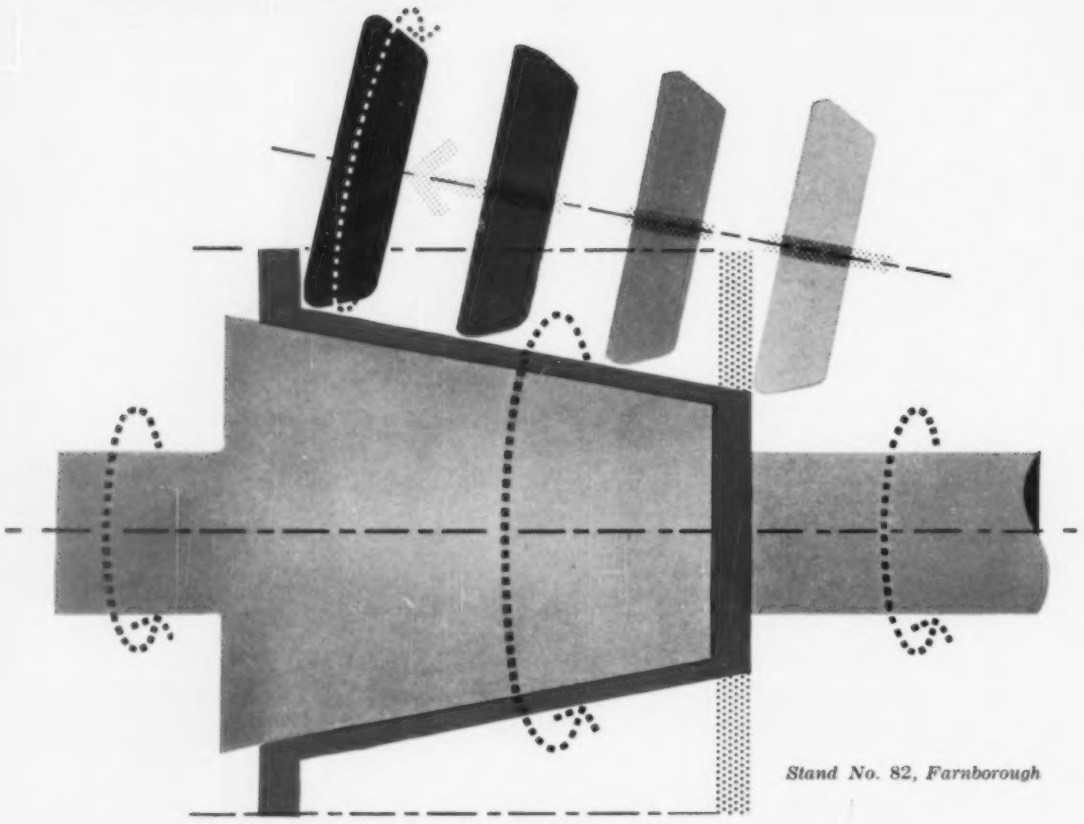

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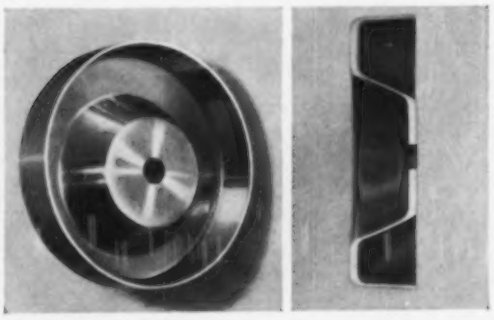

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The illustration is shown by courtesy of Folland Aircraft Limited.

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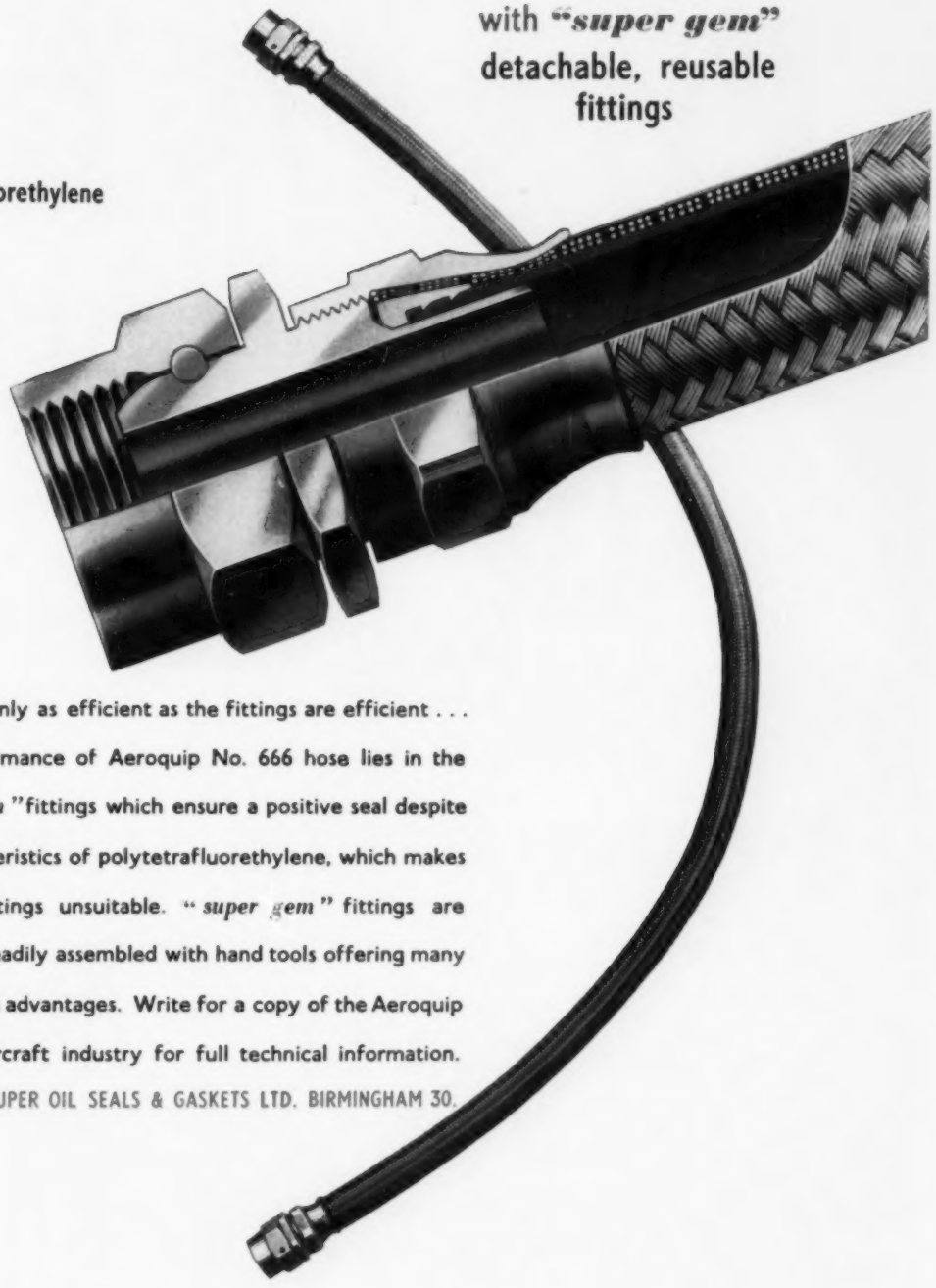

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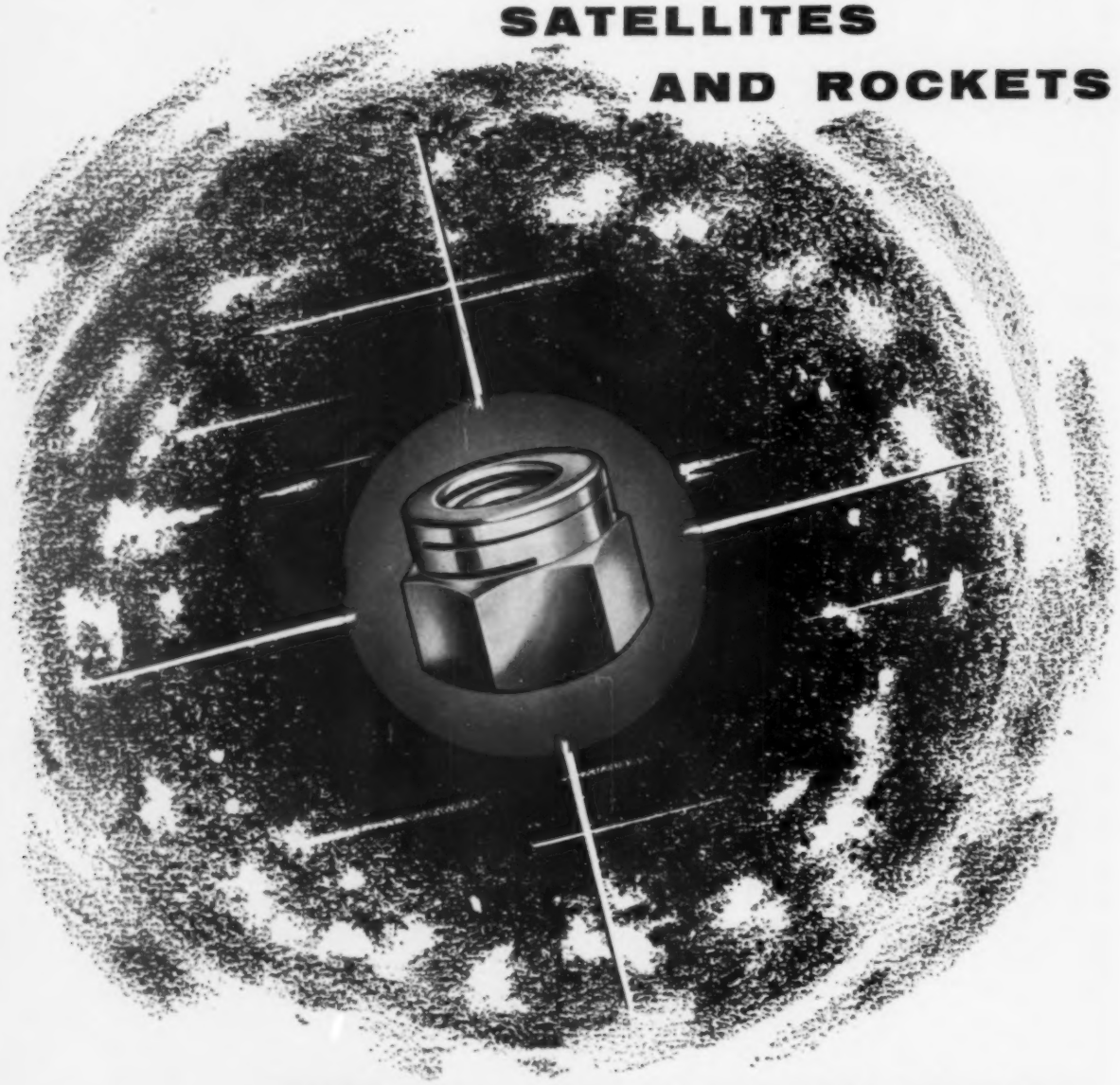

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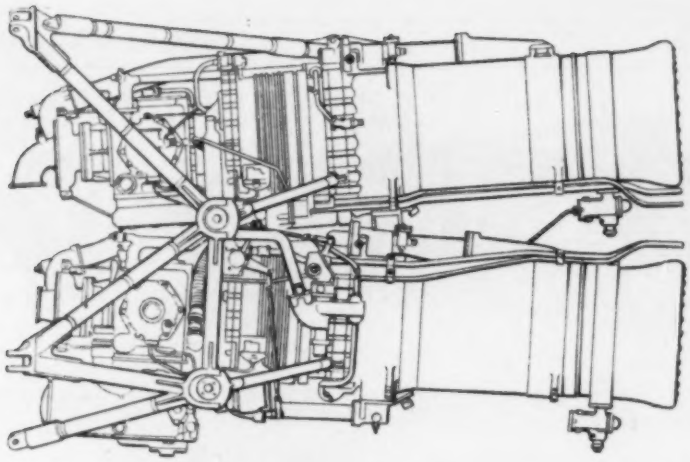


de Havilland Double Spectre. Double-barrel rocket engine for supersonic applications. Two chambers, each fed with H.T.P. and kerosine by turbopumps, the lower chamber being infinitely controllable. Overall width, with mounting, 36.6in; height, 37.5in; length, 58.6in; all other data are restricted.

British Engines 1958 . . .

would suggest. Compared with Thor the 801 is probably designed for a higher Mach number, although whether its application lies in an outgrowth of Bloodhound or in an entirely different field cannot yet be stated.

THE DE HAVILLAND ENGINE CO., LTD.

Leavesden Aerodrome, Herts.
Telephone: Garston 4000

Gnome Since 1951 de Havilland Engines have exchanged technical information with the General Electric Co. of America, and in February last it was announced that D.H. will licence-produce the G.E. T58 turboshaft engine. Largely on account of its advanced design of compressor, which has ten axial stages with four rows of variable stators, the T58 is by a wide margin the lightest engine in the world for its power. The free output turbine is coupled to a rear drive shaft which transmits through a double-helical reduction gear and thence to a helicopter secondary gearbox or, in a fixed-wing machine, to a high-speed shaft taking the drive forward again to a propeller gearbox.

In its initial form the Gnome will differ very little from the basic American engine. D.H. Engines now have a T58 on the bed for calibration and expect to make production deliveries next year.

Gyron Conceived as the optimum large turbojet for flight at Mach numbers of the order of 2.5 to 3, the Gyron first ran in January 1953. In mid-1955 it was type-tested at 15,000 lb thrust and has since run at well over 20,000 lb dry and 29,000 lb with reheat. The single compressor spool handles an exceptional airflow per unit frontal area, and the whole rotating assembly is hung between only two bearings. Various types of afterburner and propelling nozzle have been developed, and flight development has been conducted with two Gyrons installed in a Short Sperrin bomber. Development is proceeding as a company venture for the Hawker P.1121 strike aircraft.

Gyron Junior Broadly speaking, this neat engine is a Gyron scaled down to handle 40 per cent as much airflow, and the result is a turbojet which started its life rated at 7,000 lb thrust. The Junior first ran in August 1955. Extensive development of various types of powerplant has since taken place, and flight trials have been conducted with engines mounted in a Canberra. The Junior is the standard powerplant of the Blackburn NA.39 naval strike aircraft.

Like its larger ancestor, the Junior has been developed in more than one form, and examples are running with supersonic intakes and nozzles, afterburners giving up to 40 per cent additional thrust with reheat to 2,000 deg K and large manifolds for the extraction of high percentages of bleed air. Two reheat engines are shortly to start flight development in a Javelin. The latest mark of Junior to be cleared for external description is the DGJ.10. Compared with earlier versions this has a longer compressor, presumably capable of handling a greater airflow at a higher pressure ratio; variable-incidence blading is used for the inlet guide vanes and first row of stators.

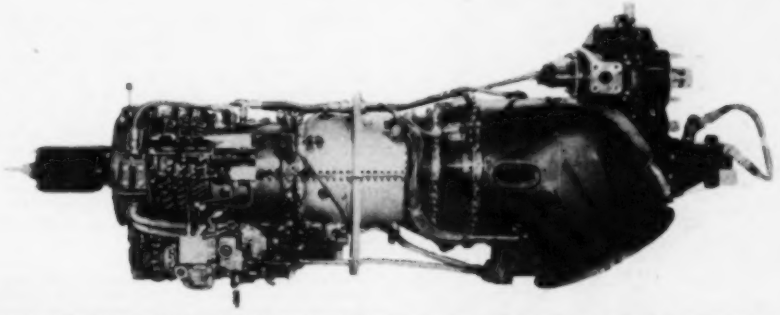
Spectre Most powerful of the D.H. family of H.T.P./kerosine rocket motors, the Spectre is a very highly developed unit existing in various forms. One range of Spectres consists of fully equipped, controllable units for permanent installation in aircraft and missiles; the other series are simpler, fixed-thrust units for boost propulsion or take-off assistance.

All Spectres incorporate integral turbopumps feeding the propellants from remote tankage. The aircraft motors, which have been flown in the supersonic SR.53s, are fully controllable from maximum thrust down to a very low idling thrust, response being immediate. The a.t.o. Spectre is in pre-production at Leavesden for Victor and Vulcan bombers; the motor is housed in a nacelle which, after firing, can be retrieved by parachute for re-use.

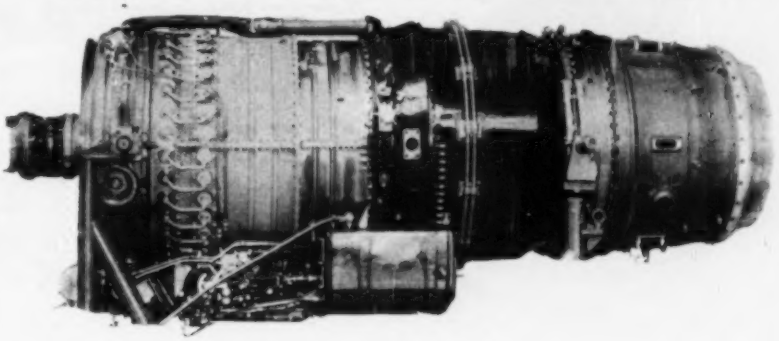
Most important of the Spectre family at present is the Double Spectre in which two units, one fully variable and one fixed-thrust, are combined in a single installational package. As the drawing shows, the upper (fixed-thrust) barrel is tilted slightly upwards, doubtless so that its thrust-line shall pass close to the c.g. of the airframe in which it is mounted. The application of the Double Spectre may not be stated, but it is obviously intended to fly a considerable distance at highly supersonic speed.

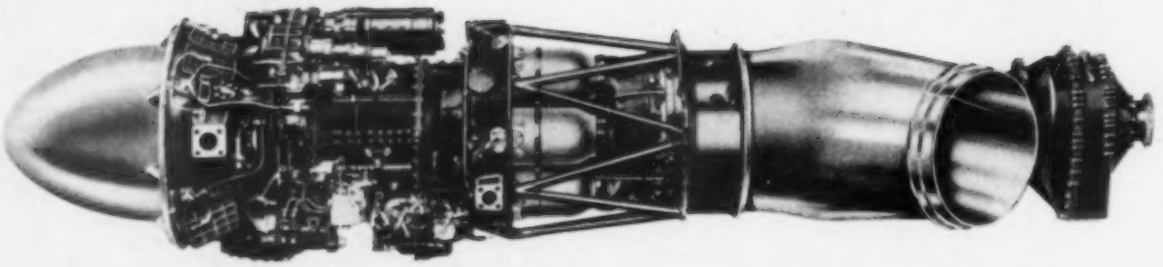
Super Sprite A descendent of the original Sprite "cold" motor (i.e., H.T.P. only, without kerosine), the Super Sprite is a fixed-thrust rocket motor supplied with H.T.P. and kerosine fed by gas pressure from tanks forming an integral part of the motor package. The whole is installed in a nacelle which is attached

de Havilland Gnome. Turboshaft engine for helicopters (and, later, for fixed-wing aircraft). Ten-stage compressor, with variable-incidence guide vanes and first three stages of stator blades; annular combustion chamber, two-stage compressor turbine and single-stage power turbine. Overall width, 17in; height over reduction gearbox, 27.1in; length, from intake, 60.335in; weight with gearbox, 350 lb; mass flow, 12.4 lb/sec; pressure ratio, 8.3:1; maximum one-hour rating, 1,000 s.h.p. at 19,500 power-turbine r.p.m. with s.f.c. of 0.65.



de Havilland Gyron Junior DGJ.10. Turbojet for supersonic applications; this engine has an afterburner which is not illustrated. Single-spool axial compressor, annular combustion chamber with 13 burners and single turbine (probably with two stages). Overall diameter, 32.3in; overall length, approximately 70in as illustrated; maximum thrust, considerably greater than 7,000 lb; all other data are restricted.





Napier Eland 229. Single-shaft turbine for helicopter propulsion. Ten-stage compressor, six combustion chambers, three-stage turbine and rear drive to primary gearbox and fluid coupling (the latter is not shown). Overall diameter, 36in; length, 102in without primary box; dry weight without primary box, 1,475 lb; rated power, 2,920 s.h.p. in the present Westminster prototype, but to be in the range 3,500 to 4,000 s.h.p. in production engines.

British Engines 1958 . . .

beneath a Valiant wing to provide take-off assistance, the nacelle being recovered by parachute for re-use. The complete a.t.o. pack has been in production since 1956.

Piston engines Production is continuing upon the four-cylinder Gipsy Major and the six-cylinder Queen. The latter is being made in two versions, the supercharged and geared Queen 70 (380 h.p.) and the Queen 30 (250 h.p.). Most important of the Majors is the series 215 engine, rather larger than earlier versions and rated at 215 h.p. As the powerplant of the Skeeter helicopter it has recently been fitted with a turbo-supercharger to maintain full output up to 4,000ft at I.S.A. plus 30 deg C. The added parts comprise a double-entry downdraught axial turbine and a modified Queen 70 supercharger impeller.

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Eland Largest of Napier's current range of aero engines, the Eland is an attractive single-shaft unit in the power range from 3,000 to 4,000 s.h.p. Already it has been adopted in a number of forms, in all of which the basic gas-producing section remains unchanged. The main rotating assembly comprises an axial compressor with variable entry vanes and aluminium-bronze blading, driven by a three-stage turbine. The whole unit has been designed in "package" form, so that the reduction gear, compressor, combustion chambers or turbine can be removed individually.

Most flight experience has been gained with the Eland in turboprop form, in which a two-stage epicyclic reduction gear, incorporating a novel hydraulic torquemeter, is attached at the front of the engine. Such units are in production for the Canadair 540 and for the conversion of CV-340s and other aircraft. For the Westminster helicopter the drive is taken out at the rear, the primary gearbox being driven from an extension-shaft and hydraulic clutch behind the turbine and the exhaust being ducted away to one side. For the Rotodyne helicopter the Eland drives both a conventional "fixed-wing" gearbox and propeller, and an additional drive is taken out at the rear via a hydraulic clutch to an auxiliary compressor which supplies air for the rotor pressure-jets.

Gazelle Like the Eland, the Gazelle is a single-spool axial engine, and it has been developed in the first instance specifically for the propulsion of rotary-wing aircraft. It can be mounted at any desired angle, and is installed in the Westland Wessex at about 35 deg to the horizontal and in the Bristol 192 almost vertically. As it is a free-turbine engine—in which respect it differs from the Eland—the usual clutch can be eliminated from the rotor drive. Accessories are mounted on the rear, or upper, face of the large magnesium-alloy intake casting, and can include a fan-driven oil cooler and an i.p.n. or cartridge starter.

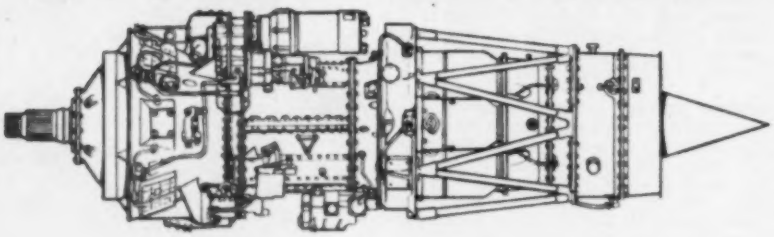
Gazelle Junior Under the company project number of E.222, Napier have planned a free-turbine engine which is virtually a slightly smaller Gazelle. Like its predecessor it would be an omni-angle engine suitable for helicopter propulsion. Ratings would start in the range 900 to 1,000 s.h.p. and would eventually reach up to about 1,500 h.p.

Ramjets During the past five years Napier have designed, built and progressively improved upon, a range of ramjet test vehicles, under contract to the National Gas Turbine Establishment at Pyestock. In their latest form these vehicles have a circular intake with a shock-forming centre-body, a long diffuser section split by a diametral extension behind the centre-body, and conventional combustion and nozzle sections. Inside the diametral box are housed ram-air turbopumps and multiple cells for kerosine fuel. The whole is launched at a steep angle by wrap-round boost motors; there are no wings or means for flight guidance, stability being provided by fins. Mach numbers of well over 2 have been achieved, as have altitudes of at least 114,000ft.

Rocket Motors Napier have delivered large numbers of liquid-propellant rocket motors for numerous missiles and test vehicles. From these have been evolved a series of more sophisticated units intended for aircraft propulsion, or aircraft boost propulsion. The basic single-chamber unit, named the Scorpion, has a

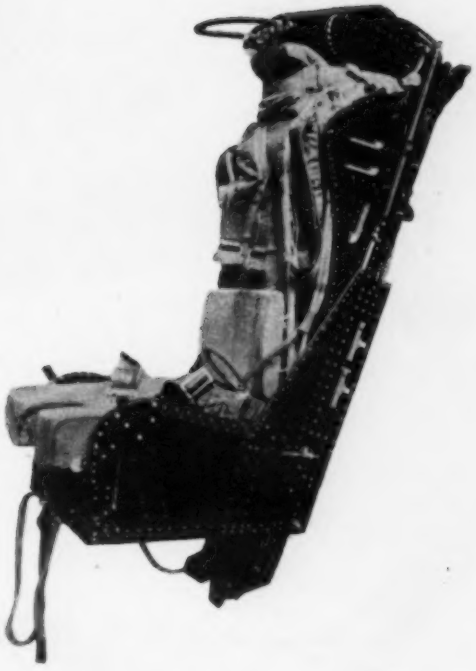
Napier Gazelle NGa.13. Free-turbine shaft-drive helicopter engine. Eleven-stage compressor, six interconnected combustion chambers, two-stage compressor turbine and single-stage power turbine. Overall diameter (intake casting), 33.5in; overall height, 70in; equipped dry weight, 865 lb; maximum rating, 1,800 s.h.p. (5-min limit) at 20,400 compressor r.p.m. with s.f.c. of 0.664, or 1,450 s.h.p. (one-hour) at 19,500 compressor r.p.m. with s.f.c. of 0.703. Note: this engine can be mounted at any angle and is shown in the vertical position.

Napier Eland NEl.4. Single-shaft turboprop. Ten-stage compressor, six combustion chambers and three-stage turbine. Overall diameter, 36in; length, 120in; equipped dry weight, 1,735 lb; mass flow, 31 lb/sec; pressure ratio, 7:1; maximum rating, 3,500 s.h.p. (3,150 s.h.p.) at 12,500 r.p.m. with s.f.c. of 0.595.



In quantity production

In quantity production for the United States Navy, Martin-Baker patent Mk.A5 and G5 fully automatic ejection seats are installed in the Grumman F9F-8T Cougar Trainer and the Chance Vought F8U-3 Crusader. Both of these seats are fully capable of ground-level ejection as successfully demonstrated at the U.S. Naval Air Test Centre, Patuxent River, on August 28th, 1957.



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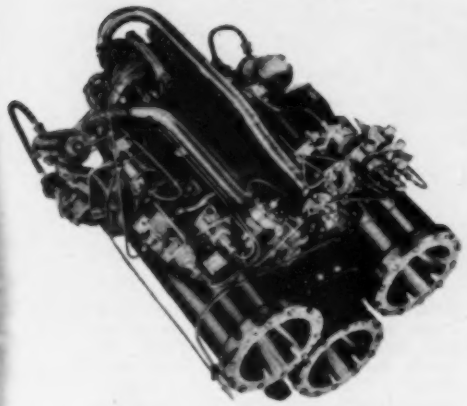

British Engines 1958 . . .

parallel-sided, regeneratively cooled chamber fed by turbopumps with H.T.P. and kerosine, and rated at 4,000 lb. A twin-barrelled version known as the Double Scorpion was instrumental in enabling a Canberra to set an altitude record of 70,310ft last year and the illustration shows the Triple Scorpion. All these units are characterized by their notably compact dimensions. Yet another series of rocket motors has been evolved for the tip-boosting of helicopter rotors. These are extremely small "cold" rockets, fed with H.T.P. monopropellant from a tank above the rotor hub.

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Avon For many years the most important British aero engine, the Avon was Rolls-Royce's first axial engine to go into production (in 1950). There have been several major stages in its development. The original 100-series, with ratings from 6,500 to 8,050 lb dry, or 9,500 lb with afterburner, is widely used in Canberras, Hunters, Swifts, Lansens (licence-built in Sweden), Sabres (licence-built in Australia) and Comet 2s. These engines have been superseded by the more efficient 200-series, with higher pressure ratio, greater mass flow and a can-annular combustion chamber. Fully described in our issue of October 11, 1957, these engines are in production for civil and military applications.

In the military field, the first delivery of these engines was for the Valiant, which has units rated at rather more than 10,000 lb each. Next came the later marks of Hunter, and considerably more powerful Avons are now in production for such machines as the P.1B Lightning, Scimitar, Sea Vixen and (in Sweden) the Draken. The RA.24, for example, has a dry rating of 11,250 lb, and the engines of the Lightning and Draken must have ratings of at least 15,000 lb with full reheat.

The civil Avon is the RA.29, in which a zero-stage on the compressor, an extra stage on the turbine and many other refinements have led to the lowest specific fuel consumption for any type-tested simple (i.e., not by-pass) turbojet. Present RA.29s are in production at 10,500 lb for the Comet and Caravelle, and have been approved for the record initial overhaul life of 1,000 hr. Later engines have ratings up to 13,000 lb.

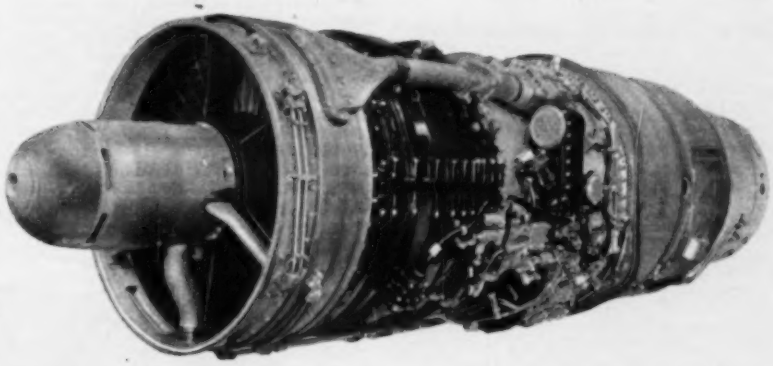
RB.106 This large turbojet was designed for flight at Mach numbers greater than 2, and was at one time considered for the Avro Arrow. Doubtless it has led to later supersonic designs.

RB.108 Descended from the RB.82 Soar, this turbojet is a small engine of high thrust/weight ratio, with VTO applications. Five are fitted to the Short SC.1, one for propulsion and four for lift. Unlike the Soar, the 108 is not of monocoque construction; its rating is 2,010 lb.

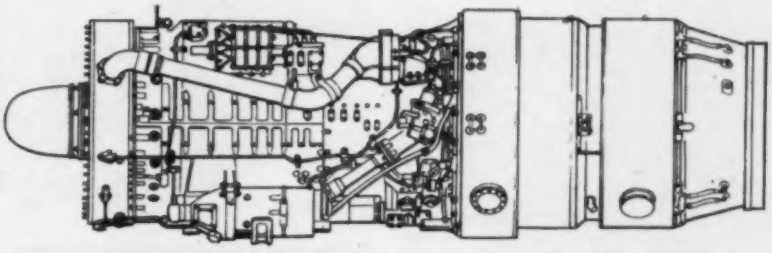
Conway This name identifies a family of by-pass turbojets ranging from a 9,250 lb-thrust engine of 1950 to today's RCo.18 of precisely twice the thrust. The by-pass principle is, briefly, that of employing an oversize low-pressure compressor, the excess delivery from which is ducted around the h.p. compressor and combustion chamber to re-enter the gas stream further aft. Compared with simple turbojets, the by-pass engine can be made extremely competitive in the matters of specific consumption and noise level, and it also has unique installational advantages.

Production is now in hand upon the RCo.11 for the Victor B.2 bomber, with a rating of 17,250 lb. At the same time, deliveries are about to begin of commercial engines in the 500-series for the Boeing 707-420 and DC-8, with dry ratings (RCo.10) of 16,500 lb. Future civil Conways will have ratings of 17,500 lb and

Napier Triple Scorpion. Three-barrel rocket engine for piloted aircraft applications. Each barrel can be fired individually. Overall width, 21.5in; overall height, 17.75in; length, 35in. All other data are restricted.

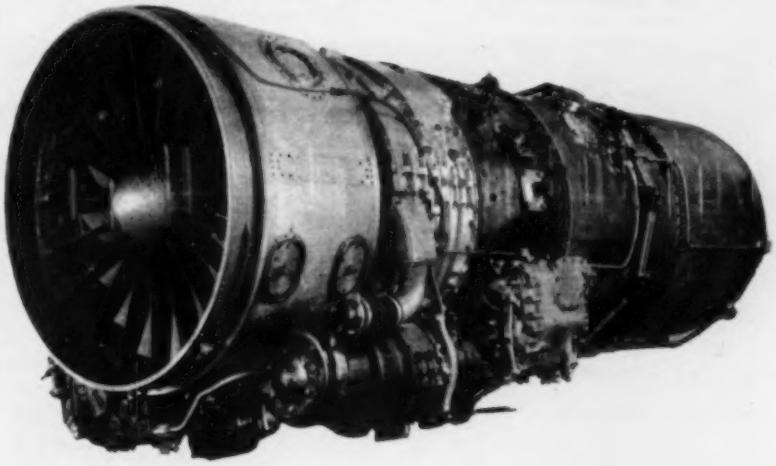


Rolls-Royce Avon RA.24. Single-shaft turbojet. Multi-stage compressor (15 stages in the related RA.28), can-annular combustion chamber with eight burners, two-stage turbine. Overall diameter, 41.5in; overall length, approximately 113in; maximum dry thrust, without reheat, 11,250 lb. All other data are restricted.



Rolls-Royce Avon 524 (RA.29 rating). Single-shaft turbojet. Sixteen-stage compressor, can-annular combustion chamber with eight fuel injectors and three-stage turbine. Overall diameter, 41.5in (carcase diameter, 36in); overall length, as illustrated, 124.8in; dry weight, 3,326 lb; maximum thrust, 10,500 lb at 8,000 r.p.m. with s.f.c. of 0.775. All other data are restricted.

Rolls-Royce Conway 505 (RCo.10 rating). Two-spool by-pass turbojet for commercial transports. Multi-stage low-pressure compressor, flow-divider, multi-stage high-pressure compressor of smaller diameter, annular combustion chamber with ten Duplex burners, independent high-pressure and low-pressure turbines and inner and outer jet-pipes. Overall carcase diameter, 42in; overall length as depicted, 132.45in; maximum thrust, 16,500 lb. All other data are restricted.



British Engines 1958 . . .

18,500 lb, these being guaranteed minimum figures.

R .141 In its essentials the 141 will be a scaled-down late-model Conway, and it will have an initial rating of 12,000 lb. Designed purely for airline operation, it will have a higher by-pass ratio than the Conway, giving minimum s.f.c. and low noise-level. The drawing indicates the accessory package and reverse-thrust nozzle. Three RB.141s will power the Airco D.H.121 transport.

RB.142 This is a military version of the RB.141 by-pass turbojet. All details of its design and performance are withheld.

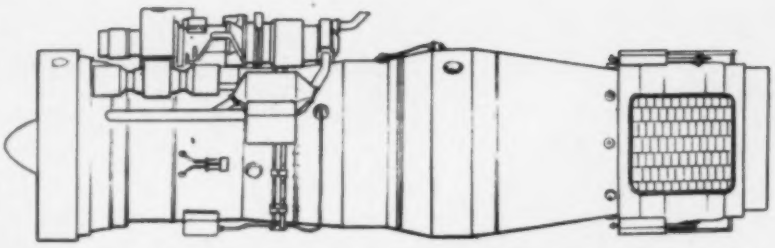
Dart Almost two thousand of these reliable turboprops have now been produced. The vast majority have been installed in Viscounts, and in this aircraft the Dart has recorded well over five million flight-hours, many times as much as any other commercial gas turbine. The Mk 506 engine has an overhaul life with Trans-Canada Airlines of 2,000 hr, and should soon surpass that of any piston engine.

Most of the engines at present in use are of the Mk 510 type, with a rating of 1,600 s.h.p. or 1,742 e.h.p. The more powerful version illustrated differs in having a third turbine stage, and it offers still lower specific fuel consumption and higher power. In Viscounts a limit of 1,800 s.h.p. is normal (1,990 e.h.p.), but in other aircraft higher powers up to more than 1,900 s.h.p. can be utilized, with propellers up to 12ft in diameter. Darts of the 520-525 series power the Herald, Gulfstream, Friendship/F.27 and several members of the A.W.650-670 family.

At present the most advanced type of Dart yet announced is the 540-series, for the RDa.11 ratings of around 2,600 s.h.p. These engines incorporate numerous further major design-improvements to reduce specific consumption and improve efficiency. One of this family recently completed a full military type-test at a wet rating of 3,200 s.h.p.

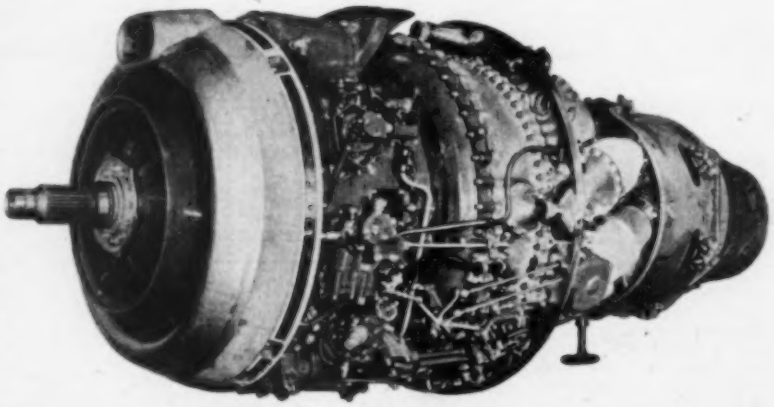
Tyne Originally this turboprop was planned as a 2,500 h.p. successor to the Dart, and design began under the company experimental nomenclature of RB.109. As the design progressed the power crept up to 4,000 h.p. and at this level the engine was selected by Vickers-Armstrongs as the powerplant of the Vanguard. Nevertheless the need for greater weight and higher speed kept the upward march of power in progress and already the Tyne is in the 5,000 h.p. class—it being the lightest and most efficient 5,000 h.p. engine known.

Making use of the latest aerodynamic, structural and metallurgical principles, the design bears several points of similarity to the Conway and cannot therefore be commented upon. It is, however, known that the engine has two shafts, the propeller being driven by the low-pressure section, and that the turbine has air-cooled blades. Flight trials began in 1956 with a Lincoln test-bed and route experience will be gained by a twin-Tyne Elizabethan transport. First delivery to an operator will probably be when the CL-44D joins the R.C.A.F. at the beginning of 1960, closely followed by B.E.A.'s acceptance of their first Vanguard.



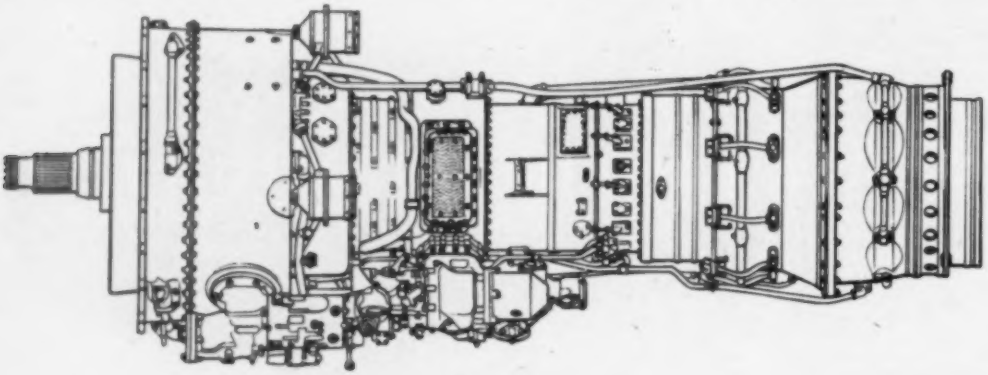
Rolls-Royce RB.141. By-pass turbojet for commercial airline operations. Maximum rated thrust at sea-level, 12,000 lb. All other data on the RB.141 are at present restricted, although the drawing affords an opportunity of determining basic dimensions and geometry.

Rocket motors Since 1955 Rolls-Royce have held a licence to manufacture large rocket motors to basic designs by North American Aviation's Rocketdyne division. The Rolls-Royce engine is likely to be virtually identical in chamber design to the 165,000 lb-thrust engine developed by Rocketdyne for the Jupiter and Thor IRBMs. This has a single gimbal-mounted chamber running on liquid oxygen and kerosine. It has been announced that the British unit will power the D.H. Propellers Blue Streak long-range ballistic missile. Static testing of the Rolls-Royce engine is to be done at the M.o.S. establishment at Spadeadam Waste, Cumberland, which is managed by Rolls-Royce.

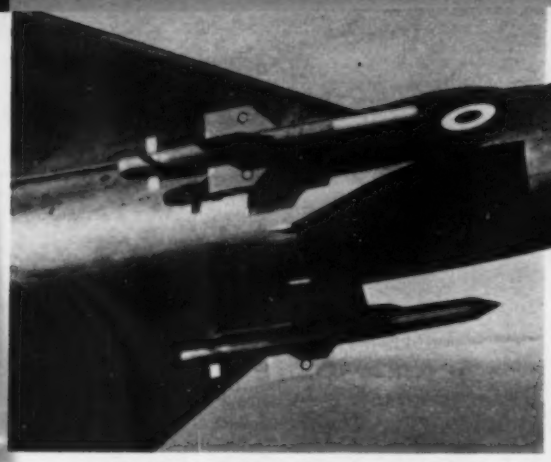


Rolls-Royce Dart RDa.7/1 Series 526. Single-shaft turboprop. Two centrifugal compressors in series, seven canted combustion chambers and three-stage turbine. Overall diameter, 38in; length, 98in; dry weight, about 1,250 lb; mass flow approximately 22 lb/sec; pressure ratio 5.62:1; maximum take-off power, 1,910 s.h.p. (2,105 e.h.p.) at 15,000 r.p.m.; cruising output at 20,000ft, 300 kt., 14,000 r.p.m., 1,225 s.h.p. with s.f.c. of 0.57.

Rolls-Royce Tyne (RTy.2 rating). Two-spool turboprop. Multi-stage low-pressure compressor, multi-stage high-pressure compressor, can-annular combustion system, single-stage high-pressure turbine and three-stage low-pressure turbine driving l-p. compressor and propeller. Overall diameter, 40.5in; overall length, 100.25in; dry weight, approximately 2,000 lb with full equipment; mass flow, 46 lb/sec; pressure ratio, 13:1; maximum rating, 5,525 e.h.p. (5,030 s.h.p.) at 15,250 l-p. r.p.m. The cruising specific fuel consumption will be about 0.4.



British Missiles 1958



D.H. Propellers Firestreaks on an English Electric P.1B.

PERHAPS for the first time, it is now possible for the general public to obtain a fair overall view of Britain's effort in the field of guided weapons. The picture that emerges is one in which absolute predominance has been placed upon acquiring a diverse range—with, it would appear, a degree of duplication—of weapons whose sole function is the destruction of manned aeroplanes. Now some thought is also being given to missiles designed for other purposes, and contracts have been let for a long-range ballistic missile and for an air-to-surface weapon for Bomber Command. In addition, the Army has the American Corporal tactical nuclear missile and Vickers-Armstrongs have developed a battlefield anti-tank device as a private venture.

Owing to our late start, the first generation of British surface-to-air weapons are in general more advanced than the U.S. Army's Nike Ajax, and correspond more closely to their contemporaries Talos and Nike Hercules. Both the R.A.F. Bloodhound and the Army Thunderbird have semi-active homing radar; that is to say, the missile homes on to radiation sent out by a powerful ground station and reflected from the target aeroplane. The Seaslug ship-to-air weapon of the Royal Navy is certainly associated with powerful ship-borne radar but its actual method of guidance has not yet been divulged. As regards their warheads, it has been announced that "the first examples" of Thunderbird and Bloodhound (and, one assumes, Seaslug also) will have H.E. charges, but that future versions will carry nuclear warheads, like those currently in use by Nike Hercules and Talos. Presumably the design and manufacture of these nuclear devices will be done completely inside the United Kingdom.

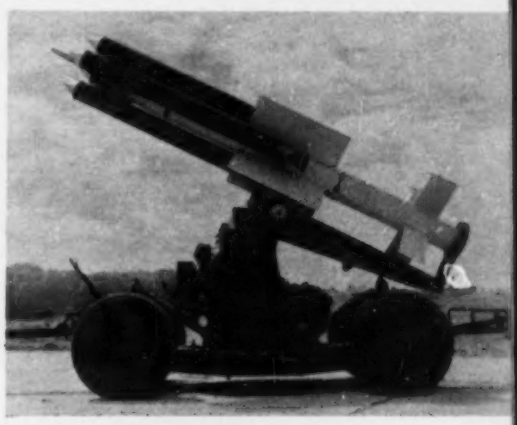
Our standard air-to-air weapon, Firestreak, is too small to carry any nuclear device yet publicly known, but is nevertheless an exceptionally potent weapon. Its guidance is of the infra-red homing variety, in contrast to the beam-riding radar guidance of the Fireflash, now in operational use by the R.A.F. as a training weapon. No advanced developments of Firestreak have been announced, nor is there yet any suggestion of a missile to replace it, although if it follows the pattern set by American air-to-air weapons it will branch out in several forms. The U.S. Air Force Falcon, for example, has appeared with both infra-red and radar guidance, and each Falcon-armed intercepter carries a mixture of both types which are fired in pairs to provide the greatest killing power under all conditions. It is also pertinent to note that no weapon comparable with the nuclear Genie air-to-air rocket has yet been announced in Europe.

Firestreak is to be the primary armament of the P.1B Lightning, Javelin and Sea Vixen, each of which is an all-weather aircraft. Either two or four rounds may be carried, and the parent aircraft houses equipment for supplying electrical power, heating and cooling services to maintain the missile in a condition ready for instant firing. The latter equipment can be housed in a streamlined package outside the aircraft, and certain machines—notably the Avon-Sabre—have been modified to operate with the Firestreak by this means.

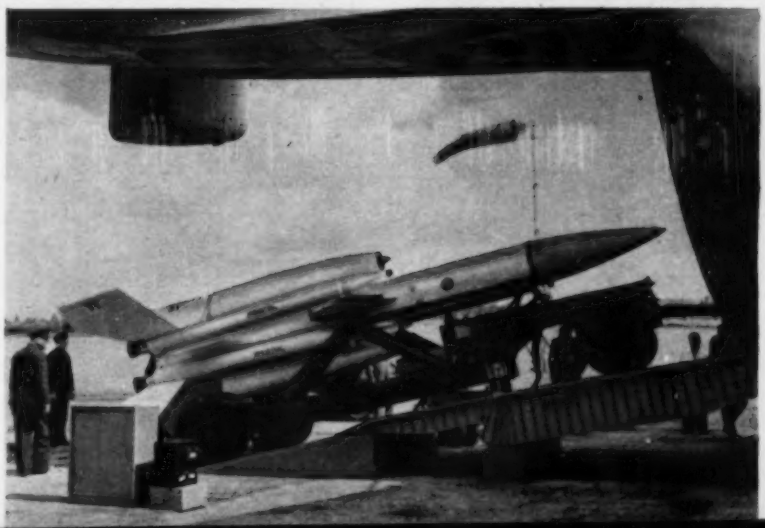
R.A.F. Bomber Command's air-to-surface weapon is at present still very much subject to security restrictions, and the only information available at the time of writing is that it is being developed under the management of A. V. Roe's Weapon Research Division at Woodford, Cheshire, and that it will become standard equipment in Vulcan and Victor squadrons. A photograph (p. 345) released in April indicates a vehicle of the expected size (about 38ft long) and reveals a canard foreplane similar to that of the U.S.A.F. Hound Dog. Clearly the Avro missile—which has acquired the curious British designation of "stand-off bomb"—must have a design range greater than the reach of good defensive radars, and corresponding American weapons are provided with tankage for ranges upwards of 350 miles. Propulsion will obviously have to be suitable for supersonic flight at altitudes of well over 70,000ft, and—in spite of the surprising choice of a turbojet for the American Hound Dog—it would appear that ramjets, rockets or a combination of both will be fitted. One can surmise that the Avro missile will have a self-contained navigation system, probably embodying inertial elements.

One field in which no effort appears yet to have been made is that of tactical bom-

Launch of a Short SX.5 surface-to-air research vehicle. Note the shallow angle.



Above, an Armstrong Whitworth Seaslug ship-to-air missile on a wheeled transporter; below, loading a Bristol Bloodhound ground-to-air weapon into a Blackburn Beverley.



British Missiles 1958 . . .

English Electric Thunderbird surface-to-air weapon, with its launcher and loading trolley.

bardment. Certain of our anti-aircraft missiles might conceivably fulfil this role, and an interesting weapon about which very little has been revealed is under development by Short Brothers and Harland. Although its primary function is that of destroying low-flying aircraft—as a direct replacement for 40mm, 2-pdr and similar guns on land and afloat—the Short missile would seem to have characteristics which might make it suitable for the delivery of heavy H.E. charges, and possibly even "below-nominal" nuclear devices, over ranges of the order of ten miles. It should be relatively very cheap to produce and obviously has some kind of accurate guidance system, although whether this is of the radio command type or of some more advanced variety cannot be revealed.

For the specialized task of knocking out armoured vehicles, strong points and any other really thick-skinned target (even a capital ship, at sufficiently short range), Vickers have produced, as a private venture, a very neat wire-controlled missile. Known as Type 891, following the company's numbering system for aircraft, the weapon is very similar to the earlier missiles by Nord and Oerlikon-Contraves, although it has the remarkably small span of 11in (which assists its controller to steer it between trees and other obstructions) and should offer a very attractive combination of low initial cost, simple and reliable components, good control and an effective warhead. The whole missile is carried in a glass-fibre case, which also serves as the launcher. Doubtless the Type 891 will be adopted by the British Army, and its manufacturer has the right to export it.

Airframe of D.H. Propellers long-range ballistic missile undergoing tests at the Hatfield plant.

By far the largest weapon-system at present under development in Britain is the Blue Streak, officially described as a "Long-range Ballistic Missile" and having a design range reported to be of the order of 2,500 nautical miles or 2,900 statute miles. It thus fills a niche between the IRBMs of the U.S.A.F. Strategic Air Command (1,500 nautical miles) and the same operator's ICBMs (5,500 nautical miles). System manager of Blue Streak is de Havilland Propellers, and other major contractors are D.H. Aircraft, Rolls-Royce and Sperry.

For this missile Rolls-Royce are licence-producing a rocket engine of basically N.A.A. Rocketdyne design. The obvious model is the highly developed 165,000 lb-thrust unit which powers the American IRBMs, and also serves for boost propulsion of the first ICBM. It would be logical for Rolls-Royce to apply their great skill as mechanical engineers to developing the gearboxes, wheelcases, accessories and, possibly, the turbopump; but they would be likely to leave the vast chamber severely alone until their experience and confidence in this type of equipment has grown. Assuming a thrust of 165,000 lb, one is led to the conclusion that the Blue Streak can outrange the IRBMs either by employing a powered second stage or by virtue of having a warhead of later design and lighter weight for the same megaton yield. Possibly the percentage structure weight may also be rather lower in the British weapon, and an unofficial report has described an airframe under test at Hatfield as being made of steel (whereas the IRBMs are fabricated principally from light alloys).

Guidance is obviously going to be purely inertial, unless some still newer system has been invented. Sperry have not previously been associated with complete inertial systems in this country (and only English Electric, who hold a Kearfott licence, and Minneapolis-Honeywell have expressed their ability to produce inertial-quality gyros). However, the parent Sperry company at Great Neck, Long Island, have done a great deal of inertial work, including long-time systems for ship navigation.

Full-scale flight trials will be conducted at Woomera, and it has been reported that they will begin in 1961. For the all-important research into warhead re-entry, Saunders-Roe are unofficially reported to have developed a test vehicle known as Black Knight. This is described as a very large rocket, with a thrust of 100 tons, and it is also apparently scheduled for flight trials at Woomera. The corresponding American X-17 re-entry test vehicle was a multi-stage device, the final stage being fired as the weapon had passed the peak of its trajectory and was plunging earthwards, so as to achieve the highest possible speed through the atmosphere. Black Knight could well operate on a similar principle.

Specifications of current British missiles appear on the succeeding two editorial pages.

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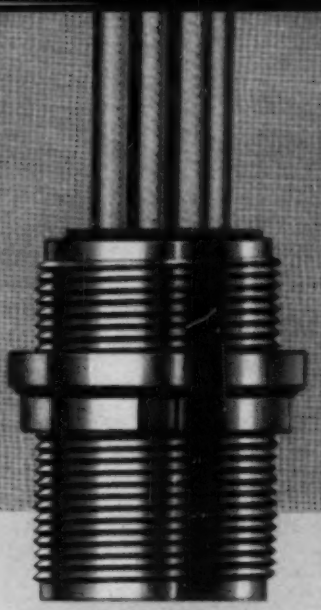

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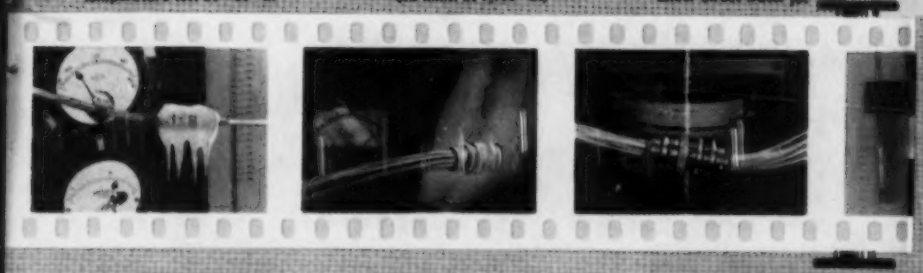

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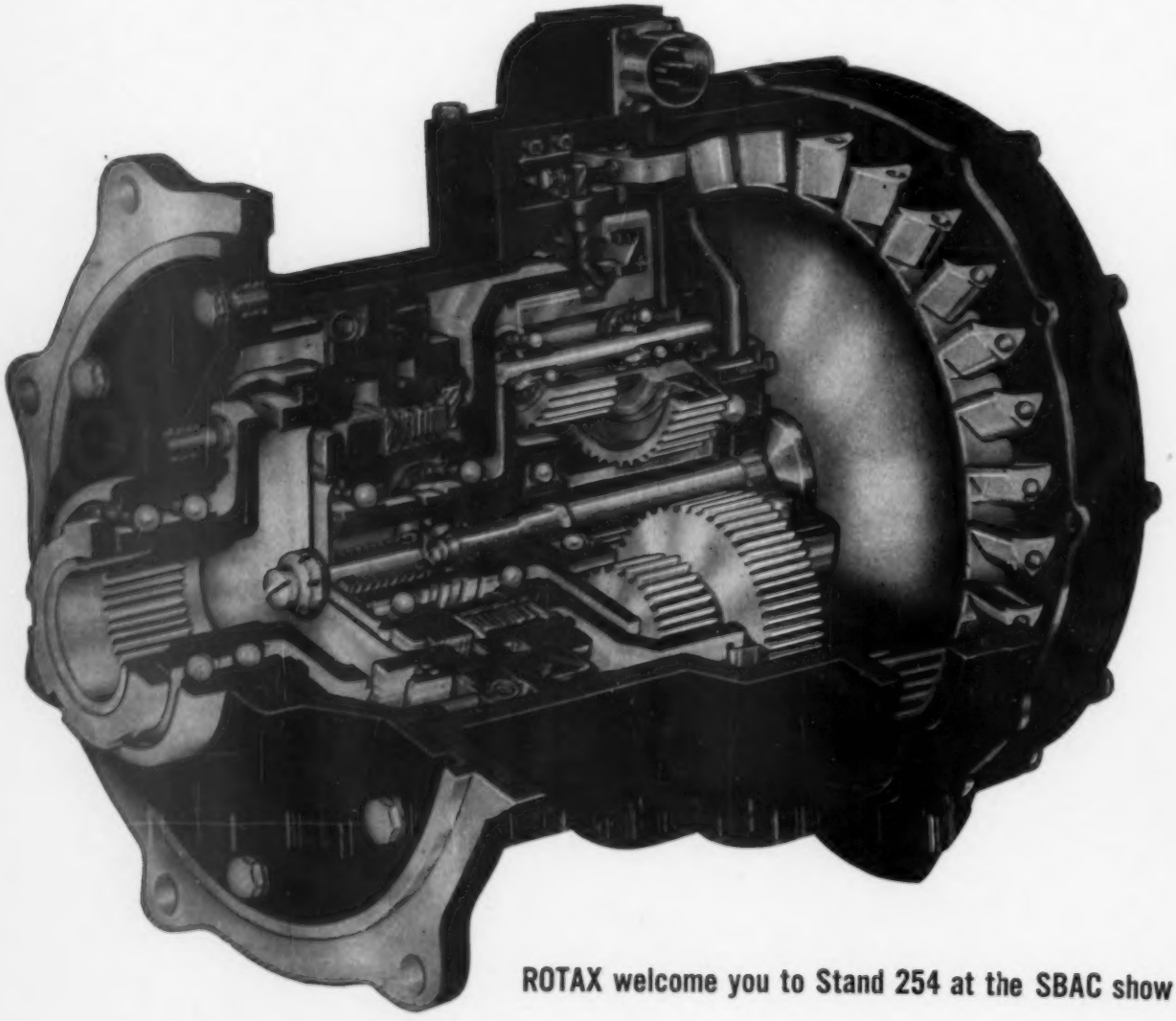

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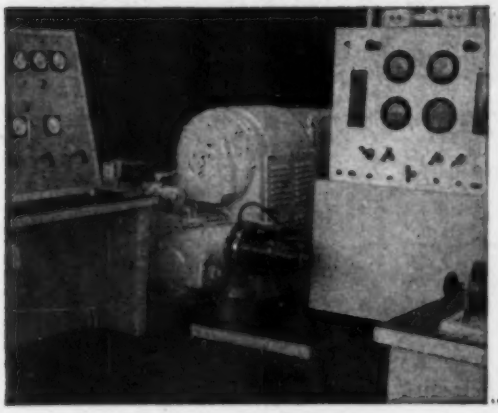

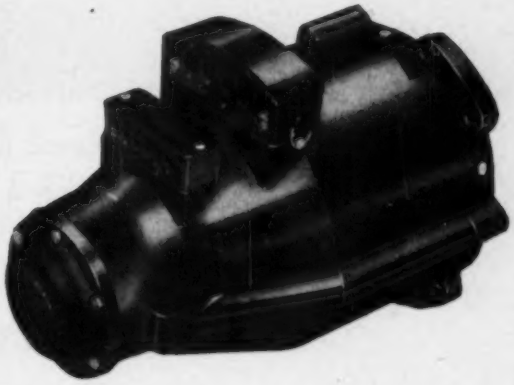

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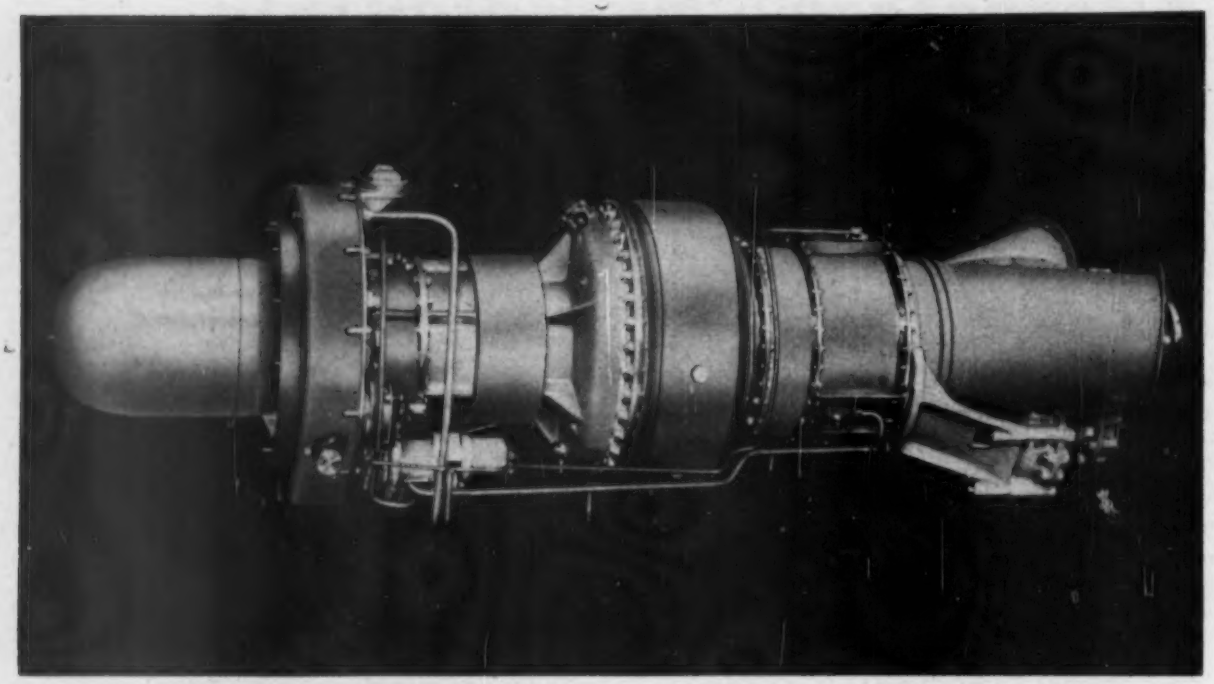

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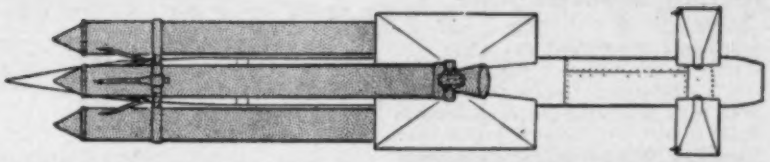

Armstrong Whitworth Seaslug. Surface-to-air. Four wrap-round boost motors, internal sustainer motor. Overall length, about 20ft; body diameter, about 16in; wing span, about 63in; control-surface span, about 63in.

IT is now possible to reveal a configuration which approximates to the production form of Seaslug, the future ship-to-air weapon of the Royal Navy. Seaslug has evolved through many major stages, but today is a remarkably compact weapon, largely owing to the forward mounting of the four large, wrap-round boost motors (which do not require stabilizing fins). The sustainer is a solid-fuel motor which greatly facilitates handling and improves safety aboard ships at sea. Targets are detected by radar at long range. When a particular aircraft has been selected its range, course and speed are obtained, and its predicted position is then used to determine the azimuth and elevation of the large lattice-type launcher, which holds three Seaslugs and is fed with missiles from a magazine below decks. No information on Seaslug's guidance may be published, although it obviously involves extensive radar equipment; two of the major collaborating companies are Sperry Gyroscope and General Electric. Numerous development firings have been made, including a number from the trials ship H.M.S. *Girdle Ness*. The accuracy of this weapon has already been demonstrated with inert rounds which have obtained direct hits on aircraft, both from the ship and at Aberporth. Seaslug will form the primary armament of the *Hampshire* class of destroyers.

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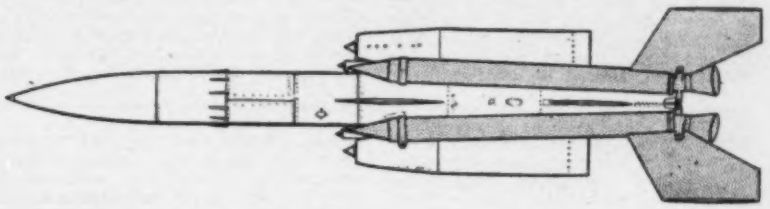
Telephone: Bramhall 1291

Avro "stand-off bomb." Air-to-surface. Vehicle basically of aeroplane configuration, with canard foreplane, rear-mounted mid wing and fixed upper and (apparently) folding lower fins. Overall length, at least 35ft; wing span, probably less than 20ft; weight and performance restricted (see accompanying text).

AT the time of writing no details whatever have been released of the air-to-surface weapon (or stand-off bomb) which Avro's W.R.D. are developing as a standard weapon for R.A.F. Bomber Command Vulcans and Victors. According to Mr. R. V. Browne, managing director of A. V. Roe in South Australia, flight trials of the vehicle are at present taking place on the range at Woomera using a Ministry of Supply Valiant as the carrier vehicle. Next year a Vulcan (possibly a Mk 2) would be employed. Mr. Browne went on to say that the weapon flew at supersonic speed at altitudes up to 60,000ft after being released 400 miles from its target. Clearly the Avro missile is designed to carry a large (perhaps 15 or 20 Megaton) warhead, and it can probably approach its target at low level or dive from high altitude.

BRISTOL AIRCRAFT, LTD.

Filton, Bristol
Telephone: Filton 3831

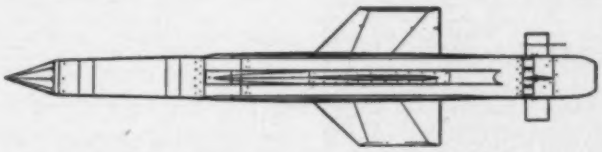


Bristol Bloodhound (Red Duster). Surface-to-air. Four wrap-round solid boost motors, two Bristol Thor ramjet sustainers. Overall length, 25ft 3in; body length, 22ft 2in; wing span, 9ft 3in; body diameter, 21in.

FOR several years Bristol Aircraft, in collaboration with Bristol Aero-Engines, Ferranti and other companies, have been perfecting a complete surface-to-air weapon system. The vehicle has been christened the Bloodhound. Powered by two Bristol Thor ramjets, it has two fixed horizontal tail surfaces and a pair of moving wings with which it manœuvres by the roll-and-steer method. Guidance is of the semi-active homing radar type, and the weapon is capable of carrying a nuclear warhead which will be fitted in versions yet to come. Bloodhound has been adopted as the standard anti-aircraft missile of R.A.F. Fighter Command. Numerous successful trials have been completed both at Aberporth and Woomera, and a training and operational base is at present being established at North Coates, Lincolnshire. The complete weapon system, which includes a mobile launcher, control post and target-illuminating radar, has been in quantity production for some time and is now being delivered to the R.A.F. It has been reported that there will be an advanced anti-missile version.

DE HAVILLAND PROPELLERS, LTD.

Hatfield, Hertfordshire
Telephone: Hatfield 2300



de Havilland Propellers Firestreak (Blue Jay). Air-to-air. Solid sustainer motor. Length, 10ft 5.28in; body diameter, 8.67in; span of wings, 29.4in; span of controls, 19.1in. Weight and performance data restricted.

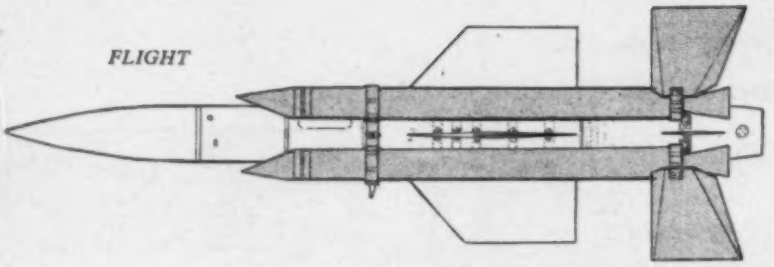
THIS company's major project is the great long-range ballistic missile Blue Streak described on an earlier page. Nothing can be added here regarding this weapon, and interest must therefore centre in Firestreak, the standard air-to-air weapon of the R.A.F. and Royal Navy. According to an American report, this weapon bears the code name of Blue Jay, and this appellation has, in fact, been publicly seen stencilled beside pressure gauges on a British fighter. The missile itself has an internal sustainer giving very high thrust for a short period. Aerodynamically the classic "British" layout is followed, there being four cruciform wings and rear-mounted control surfaces; fairings cover transmission-rods which join the latter to actuating jacks ahead of the wings. Guidance is of the infra-red homing type, the seeker cell being mounted in the nose of the missile beneath a hexagonal-section structure formed from glass panels (which are very transparent to heat radiation, although resistant to the erosion and high temperature caused by supersonic flight). Several of the missile's internal components have been publicly exhibited, and it is clear that most of the accessory services are pneumatic. Firestreak has been undergoing acceptance trials by the Joint Services Trials Unit at Woomera, and has recorded a quite exceptional proportion of kills, chiefly against Jindiviks.

British Missiles 1958 . . .

ENGLISH ELECTRIC CO. LTD.

London, W.C.2
Telephone: Covent Garden 1234

ONE of the largest industrial organizations in the United Kingdom, the English Electric Group have joined forces to prepare a surface-to-air weapon system. The missile portion, named Thunderbird, is conventionally British in configuration, having cruciform wings and rear-mounted control surfaces and four wrap-round boost motors. Solid-fuel propulsion is employed throughout, and it will doubtless be possible in future Thunderbirds to take advantage of the signficant increases in specific impulse which chemical development of solid propellants has made possible. Guidance is of the semi-active radar homing type, the receiver aerial being mounted in the nose of the missile beneath a glass-fibre radome. At the guided-weapon factory at Stevenage, Herts., Thunderbird bodies are packed in special containers which enable the units to be stored indefinitely without deterioration. When required for use, the bodies are taken to a field assembly and test point where they are subjected to a series of quick go/no-go functional tests, one of the most important of which concerns the response of the homing head. Next, wings, control surfaces and boost motors are attached, and the complete weapon is then transferred by crane to the launcher-loading trolley. As a photograph on p. 344 shows, this trolley carries the weapon in its zero-length elevating arm, which is simply slid off the trolley and on to the launcher. When the appropriate supply services have been made to the central fly-off connecter the weapon is ready to fire. Thunderbird is the standard anti-aircraft missile of the Army and an order has also been placed by the R.A.F. Very extensive firing trials have taken place in Wales and Australia and photographs have been released showing an inert round actually striking a Jindivik target aircraft. It has been announced officially that an advanced version of Thunderbird will be fitted with a nuclear warhead.

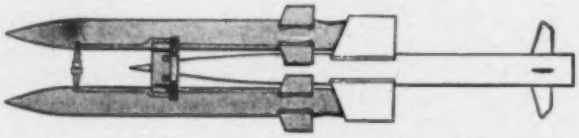


English Electric Thunderbird (Red Shoes). Surface-to-air. Four wrap-round boost motors, solid sustainer motor. Length; (with or without boosts), 21ft; body diameter, 21in over centre section; span of wings, 63in; span of control fins, 63in. Weight and performance data restricted.

FAIREY AVIATION CO., LTD.
Weapon Division

Heston, Middlesex
Telephone: Hayes 3800

FAIREY were the first British company to develop a completely proven and usable guided weapon. This was the air-to-air Fireflash system, reported to be officially termed Blue Sky, which has been in production for a considerable period as a training and indoctrination weapon for the R.A.F. As the drawing shows, the missile is of unusual configuration. Owing to the fact that guidance is effected by riding a pencil-thin radar beam from the parent aircraft, it was decided to dispense with an internal sustainer and thus prevent faulty guidance caused by ionization of the radar signals passing through the flame of a rocket motor. Instead, the missile is towed by a pair of solid fuel boost motors which are jettisoned above and below the body when their task is completed. Like most British anti-aircraft weapons, cruciform wings and rear-mounted control surfaces are fitted, and—unusually—the latter are indexed at 45 deg with respect to the wings. A relatively complete account of the design and development of Fireflash was published in our issue of August 16, 1957. The weapon is at present used by the Swift Mk 7 squadron operating from Valley, Angelsey, and it has also been fired many times by Hunters, Meteors and other types.

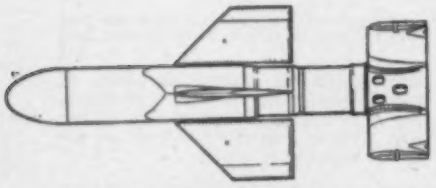


Fairey Fireflash (Blue Sky). Air-to-air. Twin solid boost motors, jettisoned after burn-out (no sustainer). Overall length, 9ft 3.75in; body length, 89.05in; span across wing cruciform, 28.11in; control-surface span, 17.97in; overall height across cruciform of boost fins, 23.63in. Weight and performance data restricted.

SHORT BROS. AND HARLAND, LTD.

Queens Island, Belfast
Telephone: Belfast 58444

FIRST revealed a year ago, the SXA.5 is a relatively simple and cheap vehicle designed for research into surface-to-air problems. It appears to be unique among British weapons in not employing wrap-round boost motors; in fact, there appears to be a solid-propellant motor, of which the first portion probably gives very high thrust for initial acceleration. Guidance, perhaps effected by radio command from the firing point, controls the flight of the weapon by pivoting the cruciform of wings. The fact that the latter are made from wrapped sheet is one of several features which suggest that the performance is lower than that of the larger, highly supersonic missiles, and range must be correspondingly low. All these factors suggest a system intended to combat low-flying aircraft, and the success of the SXA.5 research programme—films of which have shown that the vehicle is remarkably stable in flight—gained for Short Brothers and Harland a contract for the development of a small ship-to-air guided weapon. Later the First Lord of the Admiralty suggested that the new Short missile, all details of which are at present withheld, would eventually replace all light anti-aircraft guns currently used by the Royal Navy. It is clear from all that has been published that the forthcoming ship-to-air weapon system will be unusually simple and compact, and its capability of being installed in small ships as a retrospective modification is a very valuable one. The parliamentary secretary to the Ministry of Supply has stated that, "if it is the success we are expecting it could lead to . . . production orders extending over a number of years."

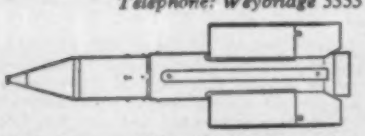


Short and Harland SXA.5. Surface-to-air research vehicle. There appear to be cruciform pivoting wings and fixed fins, the latter indexed at 45 deg, and an internal solid sustainer motor. Overall length, 77.2in; span of wings and fins, 31in. Weight and performance data restricted.

VICKERS-ARMSTRONGS (AIRCRAFT), LTD.

Weybridge, Surrey
Telephone: Weybridge 5555

AS a private venture, Vickers have developed an extremely neat anti-tank weapon system which can be carried, set up and fired by a single man. The system comprises a cruciform-winged missile contained in a portable launching canister or in a bag complete with launching stand, and a control device with which the operator generates the command signals. The latter consists of a hand-held sight and thumb-stick with which the operator "flies" the missile, signals being transmitted through a multi-cord wire. The missile is specially designed for rapid and cheap production and complete interchangeability, plastics and printed circuits being widely employed and electronics being contained in easily replaceable fairings. The four control surfaces are hinged to the trailing edges of the wings and a flare can be carried to assist in tracking over long ranges and at night. Various types of warhead can be fitted, and a newly designed hollow charge has been found to give very high lethality even against the heaviest armoured vehicles. Propulsion is effected by a solid sustainer, which initially gives very high thrust for acceleration.



Vickers-Armstrongs Type 891. Surface-to-surface. Solid sustainer motor. Length, 32.25in; body diameter, 4.5in; wing span, 11in; weight of weapon in carrying case, with optical tracking sight and cable, 35 to 40 lb.

Accessory Manufacturers' Year

NEW AND EXTENSIVELY DEVELOPED COMPONENTS IN 1958

REVIEWED in the following pages are the new and developed products of many firms that support—with ground and airborne equipment of every description—the prime manufacturers of Britain's aircraft and engines. Much of their output also finds ready sale abroad, as lists of component manufacturers for such widely-sold aircraft types as the Caravelle and Friendship (and many others besides) will testify. In spite of the hardships confronting the industry at the present time—a reduction in the numbers of manned military aircraft and concentration on a few but important types—the past year has been one not of retrenchment but of diversification. Many firms have turned part of their specialized engineering talent to serving the needs or attracting the interest of other industries, and aircraft firms may expect to benefit from the continued high volume of production for which every accessory firm must strive.

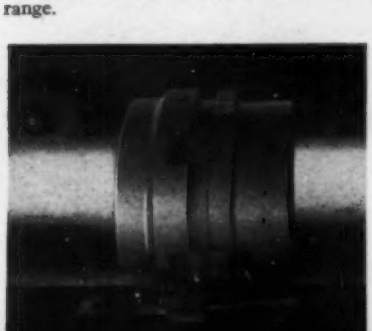
This year there have been exciting developments in the electronics field, and much steady (if not often spectacular) work on specialized components, while the contest for the supply of every type of equipment for the AW.650 and for the VC.10 and D.H.121—perhaps notably in the realm of constant speed alternator drives and generating equipment—continues unabated. The use of transistors has increased and so has the use of better low-temperature materials. Licence manufacture of the best from abroad is injecting new knowledge into the component industry and providing a valuable addition to its scope. Reliability and very long periods between component overhaul have assumed increased importance, and this feature is reflected here by including some examples of equipment which, although not very new, have recently achieved particularly noteworthy overhaul and component lives.

Avica precision bellows.

Aero Controls, Ltd. New from this Northampton firm are A-C-flex pipe-couplings, long-reach toggle fasteners and unit-construction universal joints, which supplement the range of AGS parts, toggle and shear fasteners which are in volume production. The A-C-flex coupling permits an axial movement of up to 0.35in, a flexure of 4.0 degrees, and permits a misalignment of up to 1/16in. Couplings are made in stainless steel and are suitable for fuels, oil and air up to 250 deg C and for corrosive fluids; they operate at working pressures between −11 and 125 lb/sq in and temperatures of −50 to +70 deg C. The manufacturers make the point that the coupling requires little more than hand tightening to hold pressure.

The long-reach toggle fastener is designed to M.o.S. specification D.T.D. (R.D.I.) 3006 and is suitable for panels that are otherwise difficult to close. The engagement pin has a minimum travel of 0.75in and an adjustment of 0.25in and the fastener carries a fine adjustment. The unit-construction universal joint (of the Hook's type) has the unusual capability of being able to be instantly assembled or dismantled. All components are interchangeable or replaceable so that any combination in the range of fittings can be introduced.

Appelby and Ireland, Ltd. Developed by this Basingstoke instrument firm are miniature gauges which have been designed expressly to meet a demand for a reliable pressure-measuring instrument that can be accommodated in a confined space. They are particularly suitable for in-flight test recording panels that have to be photographed. Incorporating a diaphragm pressure element of special steel the gauges can be used with steam, oil, air or other fluids and the 0.85in diameter dial is calibrated in ranges of 0 to 4,000, 0 to 5,000 or 0 to 6,000 lb/sq in. Accuracy is claimed as two per cent of the total range.



(Left) Aero Controls' A-C-flex pipe coupling.

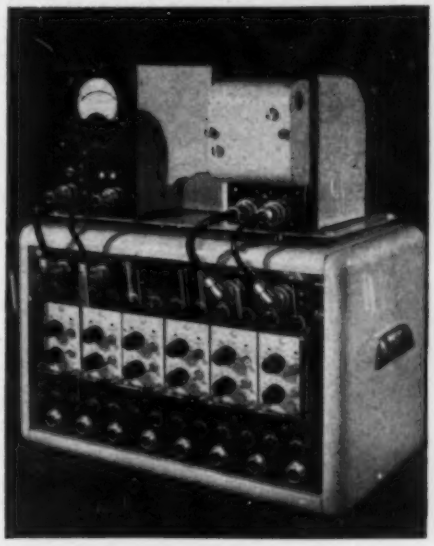
(Right) A.W. Electronics' recording galvanometer and amplifier for field trials.

Armstrong Whitworth Electronics. It is sometimes quite a difficult operation to produce even a simple component that can be counted upon to be completely reliable, particularly where environmental operating conditions are severe, and the effort devoted to development may appear to be out of proportion to the size and complexity of the results. Such a project has recently been tackled by the A.W. Electronics, who have produced a switch "to meet requirements which could not be met by any other switch either on the market or under development; no other manufacturer in the U.K., U.S.A. or Europe could be found who was prepared to meet the exacting specification." Developed initially for special circuits on guided weapons, the component has been designed for maximum reliability under adverse conditions "which," say A.W., "in most respects would be regarded as completely abnormal." The switch is completely sealed and, in its present form the one-piece moulded body is made of nylon. Considerable effort has been devoted to selecting materials, particularly for the switch contacts. A special alloy is used which renders plating, with its attendant difficulties, unnecessary. Designed for voltage and current of 24 volts, two amp D.C. or 250 volts one amp A.C., much heavier ratings can be applied without deterioration in performance.

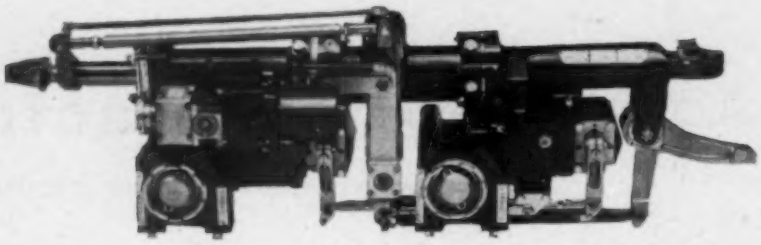
The switch has withstood steady accelerations of 50 g and an impact of 50 g mean intensity for a duration of 10 millisec together with a frequency scale of 20 c/s to 10 kc/s at intensities of up to 40 g. Environmental tests have included dry heat up to +70 deg C (maximum +80 deg C) and cold temperatures of −50 deg C. A damp heat test was carried out at a relative humidity of 95 per cent. The switch has also been shown to be watertight to 6 lb/sq in and to have an insulation resistance of 2×10^4 megohms. A.W.A. Electronics also manufacture a directional-coupler, 70 mm recording camera, five-channel display unit, high-speed sampler switch and amplifier equipment.

Avica Equipment, Ltd. Brand new from Avica is the Avica-flex Type "N" metallic flexible pipe assembly, a lightweight all-welded unit embodying seamless tubing that has satisfactorily withstood a heat-soak test of 15 min at 1,100 deg C. The company have also produced this year a range of precision barometric bellows for instruments and control systems.

Baxter, Woodhouse and Taylor, Ltd. New ideas in component electrical heating are the stock-in-trade of this company, whose products range from moulded rigid heaters, flexible heated covers and laggings (including some for use on high test peroxide equipment) to pilots' partial-pressure helmets. During the last twelve months the firm have developed for civil airliners air conditioning ducting combined with fuselage skin insulation. The



Accessory Manufacturers' Year...



Boulton Paul tandem-ram hydraulic powered-control with provision for autostabilization.

air ducts are fabricated from fire-resistant synthetic cloth with glass wool insulation fitted into a pre-formed bag which fits snugly between the frames of the aircraft structure. The bags are held in place by lacing or clips and can easily be removed for inspecting the fuselage skin or for examination of the ducting.

Bell's Asbestos and Engineering, Ltd. New silicone rubber and glass fabric air hoses known as "Flexitwist" and "Flexi-duct" have been developed by this company for application to air conditioning and de-icing systems. The new hoses allow for both flexing and twisting and are claimed to be particularly suitable where complex relative movement takes place between ducting components. An adjunct to the new hose is a silicone glass-fabric flanged connector which provides flexibility between adjacent lengths of rigid duct and permits quick removal of a section of duct from the system. A new stainless-steel wire mesh fire seal consisting of a type of stainless steel wire wool encased in proofed asbestos has also been introduced as an inter-zone firewall seal for gas turbine engines, particularly where working temperatures in the zone are high. The seal has been subject to an extensive development effort and is reported to be quite successful.

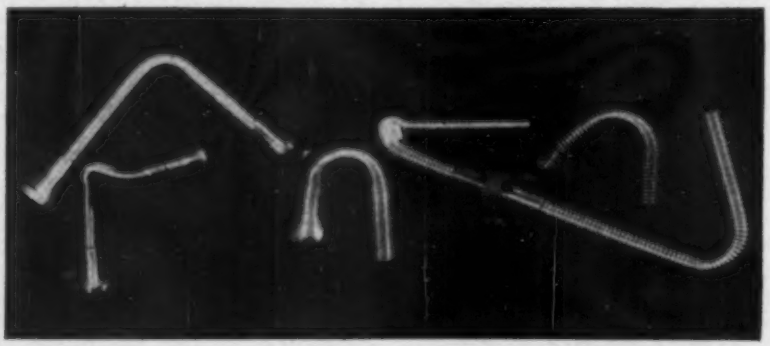
Boulton Paul Aircraft, Ltd. Ever since this famous aircraft firm evinced an interest in powered flying controls it has been studying also the wider field of control effect and pilot reaction when such mechanisms are installed; the part that the pilot plays in the control servo loop has always been the subject of particular study and interest by the firm's engineers. Recently Boulton Paul have developed for the Ministry of Supply a "human operator response analyser," as part of an extensive research programme into the human response to continuously variable visual stimuli. The machine measures and stores the squared errors in tracking over limited periods of operation, subsequently reducing them to mean values giving a measure of the overall performance of individual operators. The company say that much useful information having a direct bearing on the design of control mechanisms has been devised from tests carried out with this apparatus.

Powered-control development has been largely centred around further reductions in bulk and weight in comparison with earlier Boulton Paul designs but a mechanism for operating aircraft control surfaces pneumatically is an entirely new development.

Bristol Aeroplane Co., Ltd. Asbestos reinforced phenolic plastic drop-tanks (which show improved aerodynamic performance over metal equivalents) are also now well known; a 100 gallon tank is fitted to the Hawker Hunter. The company has now developed a wide range of high-pressure gas storage vessels, varying in shape from spherical to annular, for guided missiles and for aircraft applications, and rocket motor tubes and storage cases. The last named range in length from 24in to 18ft and in diameter from 6in to 18in.

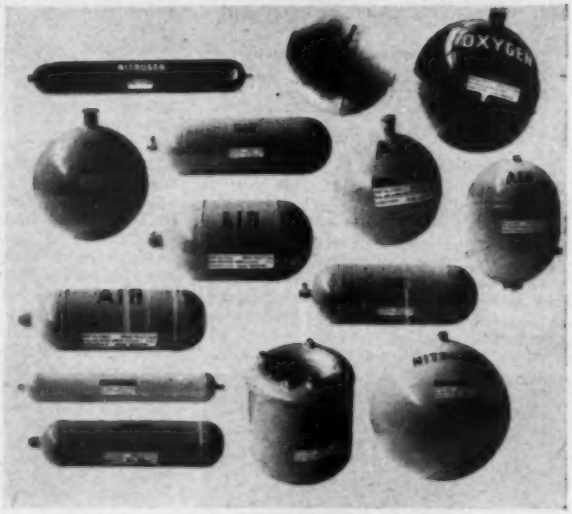
British Insulated Callender's Cables, Ltd. Specialist equipment for the guided-missile field is the current interest of this firm. A very recent development is a sub-coaxial R.F. cable comprising small cables with overall diameters of less than 0.01in. A typical example has an inner conductor of 0.0124in silver-plated copper-covered steel wire insulated with solid polythene, and plain copper wire braided and nylon sheathed to an overall nominal diameter of 0.068in. These cables are particularly intended for miniature electronic equipment. Another product is the Uni-efglas cable rated for continuous operation up to a maximum temperature of 240 deg C. Insulation is P.T.F.E. and glass, and the cable is claimed to be resistant to abrasion and to all aircraft fuel and oils. It remains flexible down to −75 deg C.

British Oxygen Aro Equipment, Ltd. This company's pioneering of liquid oxygen breathing systems in this country has progressed to the stage where systems are now being supplied for installation on the English Electric P.1, D.H. Sea Vixen, Scimitar, some marks of Gannet, Gnat trainer and others. An offshoot of this



Flexible pipes by the British Refrasil Co., Ltd. (see page 349).

(Left) Bell's Asbestos Flexitwist and Flexi-duct hot-air hoses.



(Right) A range of Bristol high-pressure containers.

Well - tried power plant . . .

The Rolls-Royce turboprop engines of the Dart Herald have an unrivalled background of operation. They embody the experience of over four million hours of airline service.

The Dart Herald carries 47 passengers, a combination of freight and passengers or more than 4½ tons of cargo in its pressurised cabin. Cruising at 275 m.p.h., its range with full tanks and a 6,200 lb. payload is more than 1,400 miles.

This efficient new turboprop airliner brings modern operational standards of speed, smoothness and reliability to short- and medium-haul operators.

DART Herald

Engines: Two Rolls-Royce Dart prop-jets

HANDLEY PAGE · RADLETT · LONDON · READING

MANOEUVRABILITY

RADIUS OF TURN
2½ n.m. (4.5 km.)
AT 45,000 FT.
(13,700 m.)
—THE TIGHTEST
TURN OF ANY
ADVANCED
AIRCRAFT

PERFORMANCE

CLIMB	45,000 ft. (13,700 m.) IN UNDER FIVE MINUTES from Brakes-Off at operational weight
RADIUS OF ACTION	500 n.m. (950 km.)
LEVEL SPEED	M.98
TAKE-OFF	400 YARDS
LANDING	600 YARDS
ARMAMENT	2,200 lb. (1,000 kg.) rockets or bombs plus two 30mm. guns

THE FOLLAND GNAT

INTERCEPTOR AND GROUND ATTACK LIGHT FIGHTER

Ordered by the Indian, Finnish and Yugoslav Air Forces
Two-seater trainer version chosen by the ROYAL AIR FORCE

FOLLAND AIRCRAFT LIMITED · HAMBLE · SOUTHAMPTON · HANTS

Accessory Manufacturers' Year...

work is the development of fuel tank explosion-suppression systems embodying nitrogen as the medium for purging the tank. Liquid nitrogen is a by-product of liquid oxygen and B.O.A.E. suggest that this should be used as the supply in a converter similar to those used for liquid oxygen. For an aircraft with 3,000 Imp. gal of fuel or more, the weight of a liquid nitrogen explosion-suppression system should not exceed 50-60 lb, because substantial savings are possible when liquid rather than gaseous nitrogen is used.

Another use for liquid nitrogen is as a heat sink. The method employed is to expand a liquid gas through a heat exchanger and eventually to atmosphere. Temperature control is maintained by a control system of valves to regulate the rate of coolant flow, which itself is maintained by the self-pressurizing characteristic of the converter. The heat exchange in vaporizing a liquid gas to ambient temperature is high and enables large cooling loads to be met for a relatively low weight. If the ratio of mean to peak cooling load is small this total loss type of cooling system allows a saving in installed weight and space.

British Oxygen have recently started to develop valves for special purposes—such as those associated with liquid gases—as a separate company activity and are prepared to undertake development work.

E.N.V. bevel gears.

The British Refrasil Co., Ltd. Stemming from their work on stainless-steel-silica heat insulation blankets this company have used their knowledge of welding light-gauge stainless steel to develop convoluted flexible pipes (see page 348) and all-welded stainless steel honeycomb core.

The former embraces a wide range of volute profiles and pipes of great flexibility, suitable for a variety of applications, are produced. The honeycomb core is machined in its expanded state and can be tapered or curved on one or both faces to within close limits.

Brown Brothers (Aircraft), Ltd. The company have now received approval for a range of ganged aircraft jacks operated either by electric or petrol-motor power; this is in addition to the standard range of three to 50-ton-capacity Rotheswan Aerojacks and is the first powered ganged equipment to be approved in the U.K.

Bryan's Aeroquipment, Ltd. Test equipment produced by this firm now includes a variable-magnitude D.C. signal-source apparatus, a leak-test rig for air-conditioning equipment and an "X" and "Y" co-ordinate plotting table. The last named is a portable means of drawing the relationship between "X" and "Y" values when these can be expressed as a voltage and can be used to plot amplifier servo response.

Chamberlain Group Services, Ltd. Although intended primarily for commercial rather than aircraft use, the Staffa hydraulic motor is included in this review because of its latent possibilities as a jet transport "wheel-mover" ground power unit. A slow-speed, high-torque unit such as this also has applications as a motor for a hoist where variable speed is required. The unit has five cylinders each with a 4in bore and 3in stroke and is designed to work at a pressure of 1,500 lb/sq in and to run at a maximum speed of 50 r.p.m. At maximum pressure and r.p.m. the output torque is 3,300 lb/ft—a little small for taxying an aircraft of "big jet" weight up a shallow incline, but more than one unit would presumably be employed.

Chloride Batteries, Ltd. Solar-activated cells are current products of the firm's development work. The cells are activated by the sun's rays and are used to re-charge small orthodox batteries; the variable output of the solar cells (which is dependent upon the intensity of the sunlight) can be converted to a steady usable supply by an orthodox accumulator. The combination is used in space satellites.

Cossor Radar and Electronics, Ltd. This year Cossor have again concentrated on the demand of air traffic control for even better radar equipment. A new display system, the CRD. 23, employs an interscan technique for displaying movable markers on the P.P.I. for use in tracking identified aircraft, and a new transponder, the SSR.1251, has been introduced as part of a secondary surveillance radar system.

E. K. Cole, Ltd. A new ground-equipment V.H.F. automatic direction finder, claimed to be the lowest-priced equipment of this nature obtainable in the U.K., has been developed at Southend. The type CE178 A.D.F. employs new methods of deriving bearing and sense information from an Adcock aerial which are claimed to improve the simplicity and reliability of the installation. Bearing indication (which avoids sense-ambiguity) is provided by a single radial line on a cathode-ray tube with an illuminated 6in-diameter scale; QDM or QTE can be selected by a switch. A continuously rotating aerial is mounted on a 28ft tower and the indicator can be installed at up to two nautical miles away.

Another new product is a range of single and three-phase transistor inverters providing 400 c/s supply from a 24V D.C. input; this consists of two single-phase inverters, giving 115V, 400 c/s rated at 75 VA and 175 VA. and two three-phase inverters rated at 225 VA and 500 VA which provide either 115 or 200V at 400 c/s.

de Havilland Propellers—see page 351.

Electro-Hydraulics, Ltd. Radical changes in aircraft landing-gear design occur infrequently; but during the past year or two Electro-Hydraulics have explored several interesting undercarriage arrangements. Twelve months ago they introduced a quadricycle configuration which is intended to combine the advantages of bicycle and tricycle undercarriage. New this year is a lift-and-roll unit—not an aircraft undercarriage, but a set of detachable-jack, oleo-pneumatic shock-absorber and wheel assemblies that can be quickly attached to a suitable baggage crate for towing to the aircraft before loading. After two or more units have been attached by quick-release fasteners, the oleos can be jacked up by a self-parking lever, until the container is about six inches from the ground; the total time for these operations is about three minutes. A typical unit capable of dealing with loads of 2,000 lb weighs 70 lb. Normally non-castoring units can be made to castor by removing a quick-release locking pin.

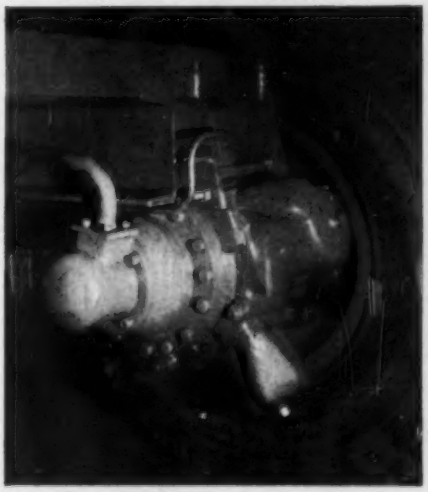
Elliott Brothers (London), Ltd. A wealth of new equipment is now appearing from Elliott Brothers, some of it built under licence from the Bendix Aviation Corporation of America. In this category is the E.B.20 automatic flight-control system, which utilizes proportional displacement plus rate signals to provide control by electro-mechanical computation. Also built under a Bendix licence are a polar-path compass, airborne weather radar RDR-1 and mobile V.H.F. communications equipment. The company have also adopted for licence construction the 10 lb-weight R.C.B.2 radio compass for light aircraft developed originally for the French Government. The company have developed also an air data computer with I.A.S., T.A.S., Mach number, height and rate of climb output.

E.M.D. Instrumentation, Ltd. Extensive development of this company's torque testing machine for checking the starting and running torques of precision bearings has enabled it to be used for testing complete synchros such as are used in many automation projects.

E.N.V. Engineering Co., Ltd. This old-established gear firm is now making spiral bevel gears for the Westland Westminster and Wessex helicopters. These are re-entrant bevel gears with profile-ground teeth for wide angle drives on the main rotors. Other aeronautical applications include propeller and accessory drive gears and flying control gears.

Ferranti, Ltd. Highly developed radar systems, culminating in the development of the Airpass radar fire-control system for the English Electric P.1B Lightning, have recently been revealed. The search-and-track radar which the system incorporates is claimed to be one of the most advanced in the world, and is small enough to be included in light-weight fighters. The radar includes a computor to calculate the flight-path to follow to the best point to launch an attack and ensures that the weapons are correctly aimed. Radar has been developed for the Blackburn NA.39 and the company have also produced an automatic bombing and survey system and

Chamberlain Services' Staffa motor.



The Frankenstein baby flotation cot can be lowered through an airliner window by straps that are part of the equipment.

Accessory Manufacturers' Year . . .

guidance for the Bloodhound missile.

Among units of less specialized application are an electro-hydraulic control valve which may be employed in a tractive system or in an electro-hydraulic servo. A feature is the lack of coupling-back from the hydraulic system to the torque motor of the valve, and very high response.

New units developed by the Aircraft Equipment department include the F.S.16 vertical-reference gyro and the T.R.500 transformer rectifier. The former, intended for use as a vertical reference and signal service for automatic pilot systems, remote attitude indicators and flight director indices, provides 360 deg freedom in roll and ±85 deg freedom in pitch. It incorporates three line synchros and toroidal potentiometers in a 4½in case.

The T.R.500 T.R.U. is a combination of Ferranti components in a package of minimum size and weight and employs silicon rectifiers that are conservatively rated. High-temperature operation has been taken into account in construction of the transformers and the output is six phase. Another line of the firm's development work is in ceramic-to-metal seals. These have been produced for temperatures of up to 700 deg C.

Flight Refuelling, Ltd. Among a really wide range of fuel system components now in production, the Mark 39 refuelling/defuelling valve, illustrated on page 351, is quite new. It will pass 240 Imp. gal/min on the refuelling side and 100 gal/min defuelling. Selection is electric with manual over-ride. A new pressure relief valve, with a g-sensitive flap valve, is also being manufactured.

P. Frankenstein and Sons (Manchester), Ltd. The well known range of air-sea rescue equipment has been extended by the introduction of the Beaufort 26-seater airline dinghy, manufactured in production by Beaufort (Air-Sea) Equipment, Ltd., of Birkenhead. Finished in brilliant blaze orange-daylight fluorescent Terylene fabric and proofed with neoprene, the new dinghy is claimed to provide greater resistance to oil and sunlight with longer life, greater strength, lower weight and more compact packing.

The company are now among those manufacturing baby's survival cots. This design has a self-erecting hood and the canopy provides protection from cold, wind, rain and spray. As the illustration shows, the cot is small enough to be passed through an airliner's window. The infant is secured with two lengths of fabric attached to either side of the floor of the cot and tied across its chest. The four-coil tubular frame and hood support are inflated from a CO_2 cylinder after pulling a toggle. A small pocket on a shoulder strap attached to each end of the cot (intended for slinging from the mother's neck or shoulder while she climbs from the aircraft) contains a 20ft webbing line for lowering the cot into the water.

Ferranti miniature artificial horizon.

General Electric Co., Ltd. During recent months the company have completed a major installation of high-intensity lighting at Southend Airport, and have also been responsible for lighting equipment at Gatwick. In another field they have developed a new air-circulation oven with three-heat control, that will be used by S.A.S. on its DC-7s, DC-8s and Caravelles. Recently G.E.C. announced a 28 volt D.C. transistor-operated lighting system for airliner cabins enabling fluorescent tubes to be used. This is a new development which will be employed on the Vickers Vanguard. A transistorized system enables the lights to be used on the ground without the need for 400 c/s inverters; low-brightness tubes three or four feet long will be installed near passengers' heads.

Other new developments include further applications of G.E.C. heavy alloy, an accelerometer made from a new piezo-electric ceramic (suitable for operation up to 250 deg C), new airborne radar, and lightweight high-voltage transformers and chokes. Using recent developments in resin casting, big reductions in size and weight have been achieved.

Sir George Godfrey and Partners, Ltd. Godfrey air-conditioning equipment for several new aircraft is now beginning to be introduced in quantity. Several units have applications on civil transports, but the Godfrey range extends also to guided missile applications. Supplementing the Godfrey/SRM type 175 compressor introduced last year are the cold air unit type CT-8, axial-fan turbine AFT-1, feed-back valve FBV-6 and butterfly valve BV-2½. All these units are designed for installation on the Vanguard and a new butterfly-type spill valve, the 3BE Mk 3 and 4, will be used on the Armstrong Whitworth AW.650.

The CT-8 cold air unit, with a mass flow of 200 lb/min, is "believed to have the largest rated output of any unit currently in production in this country," and an axial fan turbine, the AFT-1, enables the air cycle cooling system to be used on the ground. The fan is energized by an air-bleed turbine; its air mass flow is 316 lb/min for a turbine air consumption of 53 lb/min. Air for the turbine is controlled by the butterfly valve BV-2½ which is operated by an electric actuator. A feature of the valve is that the valve disc is normal to the axis of the body when closed and is positively sealed by a compression ring. As its name implies, the feed-back valve FBV-6 ducts air bled from the compressor back to the intake where it is recirculated through the compressor to increase the temperature of the air delivered to the conditioning system.

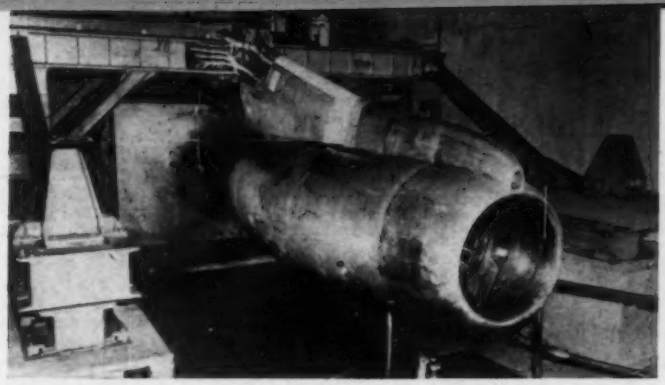
An important new unit which has recently been put into production is the turbo-alternator TGA-30. Godfrey believe that it is the only constant frequency A.C. alternator drive to have successfully completed a 100 hr test in an airborne installation. It is coupled to a 30 kVA alternator, the frequency control unit for which has been designed by Godfrey and developed in collaboration with Fergussons, Ltd.

The company have also developed the ACM8/200 combined A.C. motor and Freon 11 compressor unit, similar to other Swedish-based Godfrey/SRM compressors but with a higher pressure ratio; it weighs 9 lb. The company were responsible for the design of the motor bearings and housing and lubrication system. Maximum continuous rating is 8.5 h.p. at 23,500 r.p.m. The unit is integrated into the main cooling system and the complete motor/compressor unit weighs about 16 lb and has a refrigeration output of 38 tons.

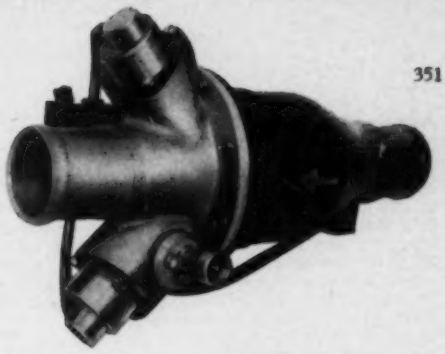
Goodman's Industries, Ltd. In the aircraft industry, the name of Goodmans is coupled with oscillators, and it is in this well-established line that the company have continued this year, adding the new E.501 control amplifier and remote control to the drive for the oscillation power amplifier. The latest development is the sweeping line wave oscillator, which is still in prototype form. The sweep law can be arbitrarily adjusted by cam selection but the basic law is logarithmic; frequency range covered in a single sweep is up to 200 to one. Frequency variation is 5 c/s to 100 kc/s in three bands, output 0-5 volts r.m.s., amplitude variation over the frequency range ±1 db, and total harmonic distortion better than one per cent.

The Goodyear Tyre and Rubber Co. (Great Britain), Ltd. Earlier this year, Goodyear introduced their "foot-thumper" skid warning system as a new and simple

Godfrey cold-air unit.

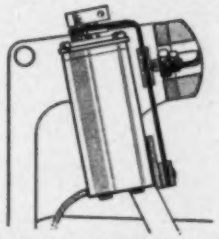


Heenan and Froude thrust cradle for Rolls-Royce Conway pod for Boeing 707-420.



Flight Refuelling, Ltd., refuelling/defuelling valve.

idea for reducing landing runs by warning the pilot when his aircraft's main wheels are skidding. It consists of a button recessed into the pilot's brake pedal which vibrates when a mainwheel is locking; a deceleration detector unit is mounted in each mainwheel (it consists of a D.C. generator energizing the indicator from the aircraft's 24 volt supply). A further component is an electrical control box. (The system was fully described in *Flight* for January 17, 1958.) The firm also manufacture a self-contained electrical anti-skid system (as opposed to a warning system) and brakes, wheels and tyres for a wide variety of aircraft. New applications for



Goodyear's pedal "foot thumper."

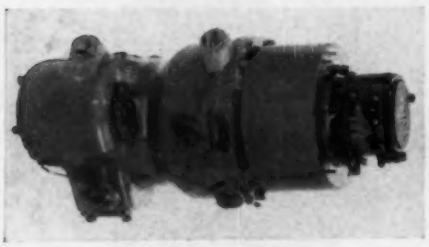
Goodyear brakes are a tri-metallic disc brake for the Viscount 810 (a similar brake is fitted to the Viscount 800 series) and a double-disc cluster-type brake for the production Handley-Page Dart Herald. Recently introduced is a hydraulic/pneumatic converter unit with an improved disc brake for the Bristol Freighter.

Goodyear are also actively continuing their work on jointing compounds and erosion-resistant coating systems.

Graseby Instruments, Ltd. New gyro test-gear has been developed by Graseby in the past twelve months, notably the Universal gyro tester type G1.390 for gyros with one or two degrees of freedom, and the polar-axis-pattern tester type 651 for carrying out the tumbling test originated at M.I.T. A three-axis accelerometer unit, the type G1.14 is also new this year.

de Havilland Propellers, Ltd. Apart from the primary work of this company on aircraft propellers and guided weapons, an extensive range of equipment is manufactured for military aircraft and for missiles.

de Havilland oil-driven tandem alternator.



The D.H. cold air unit for cockpit air-conditioning is well known and a heating pack for providing conditioned air for missiles prior to launching, and for other external stores, has been developed. Other units include vapour-cycle equipment for operating aircrew ventilated suit packs (a vapour-cycle compressor refrigeration system is being developed for the Sea Vixen, and an air-cycle system for the Victor) and a hydraulically driven airborne radar scanner unit.

For incorporation in the propellers of the Vickers Vanguard, D.H. Propellers have developed Beta control in which blade angle in the low pitch and reverse range is controlled directly by the pilot in order to improve the rapidity and sensitivity of thrust response under ground manœuvre conditions. Some of the most interesting accessories developed by the company are the work of the Alternator Division, who have developed a gas-driven unit for guided missiles and the hydraulic motor drive of an aircraft unit. A prized exhibit of the Division is an alternator retrieved from a missile fired at Woomera, which, although damaged, still functions to within the limits required of a new machine. The company's work on plastics —laminated epoxy resin, glass-fibre, Durestos and Sebalkyd—is continuing.

Heenan and Froude, Ltd. Very recently developed is a thrust cradle for the Conway engine in the podded form in which it will be supplied to Boeing for the 707-420. The cradle is designed so that the pod is cantilevered out in a representative manner.

H. M. Hobson, Ltd. A wide variety of new equipment has appeared from Hobson during the year. Very new is a constant speed alternator drive, to be manufactured in two sizes: the type 369 for alternators up to 40 kVA and the type 368 for alternators up to 30 kVA. Both have a constant output speed of 6,000 r.p.m. ± one per cent, the former over an input speed range of 2,700 to 6,850 r.p.m. and the latter over 2,663 r.p.m. to 6,850 r.p.m. A differential gearing system is used which permits the greater proportion of the power to be transmitted mechanically; a maximum of only 16 per cent of the total power is transmitted hydraulically and this occurs over the centre of the engine speed range. Since the fluid power requirement is small the working pressure is only about 500 lb/sq in and within the normal cruising range the hydraulic pump is unloaded and idles at a working pressure of 50 lb/sq in. The drive has been designed specifically for civil aircraft, and important features claimed are a very high standard of reliability and unusually low weight for this type of drive; the unit is estimated to weigh 57 lb with sump and oil but without oil cooler and input disconnect unit. The drive is designed to run on E.E.L. 3 or MIL-L-7807 oil. A speed tolerance of ± two per cent is claimed under all conditions of temperature and pressure and although a greater divergence may occur under shock electrical load or extreme input acceleration, response to within the defined tolerance is claimed to be made within 100 millisecs. The firm have also developed a flap control unit for the AW.650 and announce that the Britannia feel simulator and loading jacks types 151 and 152, have now been cleared for a life of 30,000 hr with overhaul periods of 6,000 hr.

Fuel system control developments include a new fuel flow proportioner, a reheat control system and the licence-manufactured Microjet pressure ratio control. The flow proportioners, types 333 and 334,

de Havilland hydraulically driven aircraft alternator, controller and condenser.

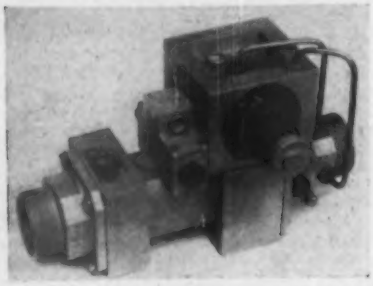
incorporate metering rotors of cycloidal form, powered by a gear-type air motor to maintain fuel pressure under failure conditions. Close running clearance components are not required and there is no likelihood of pumping air from a damaged tank.

Hobson's reheat control system consists of a turbo pump, a main flow control, a primary flow control and an ignition unit forming an integrated unit which gives a variable degree of reheat control and improved combustion efficiency.

The Hymatic Engineering Co., Ltd. This company has devoted several years of largely fundamental research into the stability problems associated with closed loop control systems embodying gas as a working medium. The PS.93 hot air reducing valve embodies the results of this research. It operates at temperatures of up to 400 deg C and will control outlet air

Accessory Manufacturers' Year...

pressure at flows of up to 400 cu ft/min to within ±½ lb/sq in at inlet pressures of 15 to 150 lb/sq in. This is a servo-operated axial flow valve with a sleeve as the control member. Another reducing valve — the PS.64/6, developed from an earlier design —has long-term compatibility with H.T.P. It reduces from up to 3,000 lb/sq in to 15 lb/sq in ±½ lb/ sq in over a flow range of 0.3 to 65 cu ft/min or more. Recently type-tested are the MD.30 and MD.34 electro-magnetic stop valves, which embody a solenoid-operated pilot valve and cover high temperature and pressure requirements. The operating time (in the



Hymatic PS. 93/1 reducing valve.

MD.34) has been reduced to below 40 millisecs and the valve will continue to operate when heavily contaminated with grit.

Integral, Ltd. Quite a substantial range of new hydraulic pumps has been produced by this Wolverhampton firm in the past twelve months. Some of these are intended to be married to other hydraulic equipment (such as the type 244, for example, which with a normal hydraulic motor can be used as a constant speed drive) while other equipment is self-contained. Two designs of powerpacks have been introduced, for application to the AW.650 and the Handley Page Dart Herald, and consist of a pump, motor and reservoir. The former pack weighs 24½ lb and delivers 1.45 gal/min at 3,000 lb/sq in, and the latter, weighing 14 lb 12 oz delivers 0.45 gal/min at 3,000 lb/sq in. Advantages claimed for these self-contained units are that they save space by reducing pipe runs, can be matched to the system served, and are suitable for operation at low temperatures because pipeline losses are low. Vertical mounting provides advantages in weight and simplicity. A new short-life pump delivering one gal/min at 3,000 lb/sq in is the type 238 and a pump for infinitely variable delivery at a true constant pressure is the type 240. The latter is one of a range of five servo-controlled hydraulic pumps in which a number of variations in performance and control characteristics are available without alteration to the basic installation dimensions. The type 240 delivers from 0 to 1 gal/min at up to 3,000 r.p.m. and 0 to 2.1 gal/min at up to 6,000 r.p.m. while operating at a constant pressure up to 4,000 lb/sq in. The unit weighs 5 lb.

Irving Air Chute of Great Britain, Ltd. Improved performance and the need for less maintenance are recently introduced features of the barometric power unit type B Mk 1. A completely new harness quick-release device that will accept from one to ten connectors has been developed and the company have also produced a new instrument for automatic disconnection of parachutes from their load when they reach the ground.

Kelvin and Hughes, Ltd. A particularly ingenious piece of equipment is the rapid processing photographic projector. Described in *Flight*'s Flying Aids special issue of May 16, 1958, this Kelvin Hughes development, designed in conjunction with the M.o.S., presents on a large screen photographically recorded and processed sequential events as they appear on a cathode ray tube or Charactron shaped beam tube. It has a continuous operating period of 24 hr and the positive processing cycle time is 12 secs. The company's very wide range of instruments continues in production and an air data computer and Doppler driven map roller are recently developed special equipment items.

The Walter Kidde Co., Ltd. Safety equipment is the concern of this firm and two lines in particular have been extensively developed during this year. B.O.A.C. Comet 4s are to be equipped with a Kidde built-in oxygen system for passengers and crew to provide them with respiratory protection in the event of cabin decompression. The system comprises high pressure oxygen cylinders, crew demand regulators, a pressure gauge, check valves, a portable oxygen unit, an aneroid-operated trigger valve, constant flow regulator and masks for each passenger with an automatic mask presentation device.

King Aircraft Corporation. A heavy-duty hook latch fastener with an ultimate tensile load of 5,500 lb has been designed which weighs only 0.51 lb, while development work on panel closing includes a hand-operated access panel for missile application where a pressure proof, completely flush access is required. Diameters range from 1¼in to 6in diameter. New couplings have been designed to provide for lateral as well as angular and linear pipe or duct displacement. Fabricated in stainless steel, the coupling is based on a twin-gimbal mounting. Another design provides for a fly-off coupling for missile applications (it separates on firing) with positive self-sealing at pressures up to 1,500 lb/sq in, while ingenuity applied to push-pull rods has resulted in a swaged control rod design offering an estimated weight saving of 18 per cent.

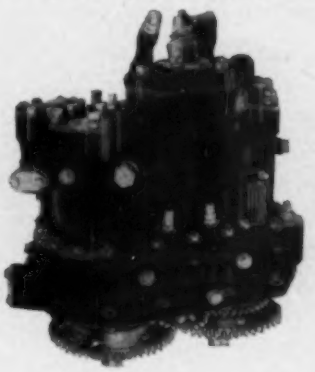
Latex Upholstery, Ltd. The airliner passenger chair field is very closely competitive and many firms have produced economy class seat designs this year. Latex apply their own special upholstery techniques to both these and to luxury designs. The range of equipment produced includes passenger escape chutes, "Kargo Pak" cabin freight containers, propeller covers and passenger safety belts.

Joseph Lucas (Gas Turbine Equipment), Ltd. It is unfortunate that some of the most exciting accessory development work that is undertaken during the year cannot, for reasons of security, be described in this review. Some of the problems facing the designers of gas turbine equipment were outlined in an article on the firm in *Flight*, June 27, 1958, and it can be safely assumed that the company's recent efforts are being directed to the solution of these technological difficulties. Still fairly new are the present range of Lucas hydraulic pumps, motors and constant speed drives, the latter for outputs of up to 60 kVA; a typical unit in the range was fully described in the article referred to above. The pump in a 25 h.p. installation delivers 77 gal/hr per 1,000 r.p.m. at full stroke and is designed to run up to 6,000 r.p.m. Satisfactory paralleling of synchronous alternators may be achieved and the loads of multiple hydraulic drives balanced by biasing the servo system.

Latex economy-class airliner seat.

For driving 40 kVA alternators, Lucas

Components of the Integral four-channel electronic mass flow-meter.

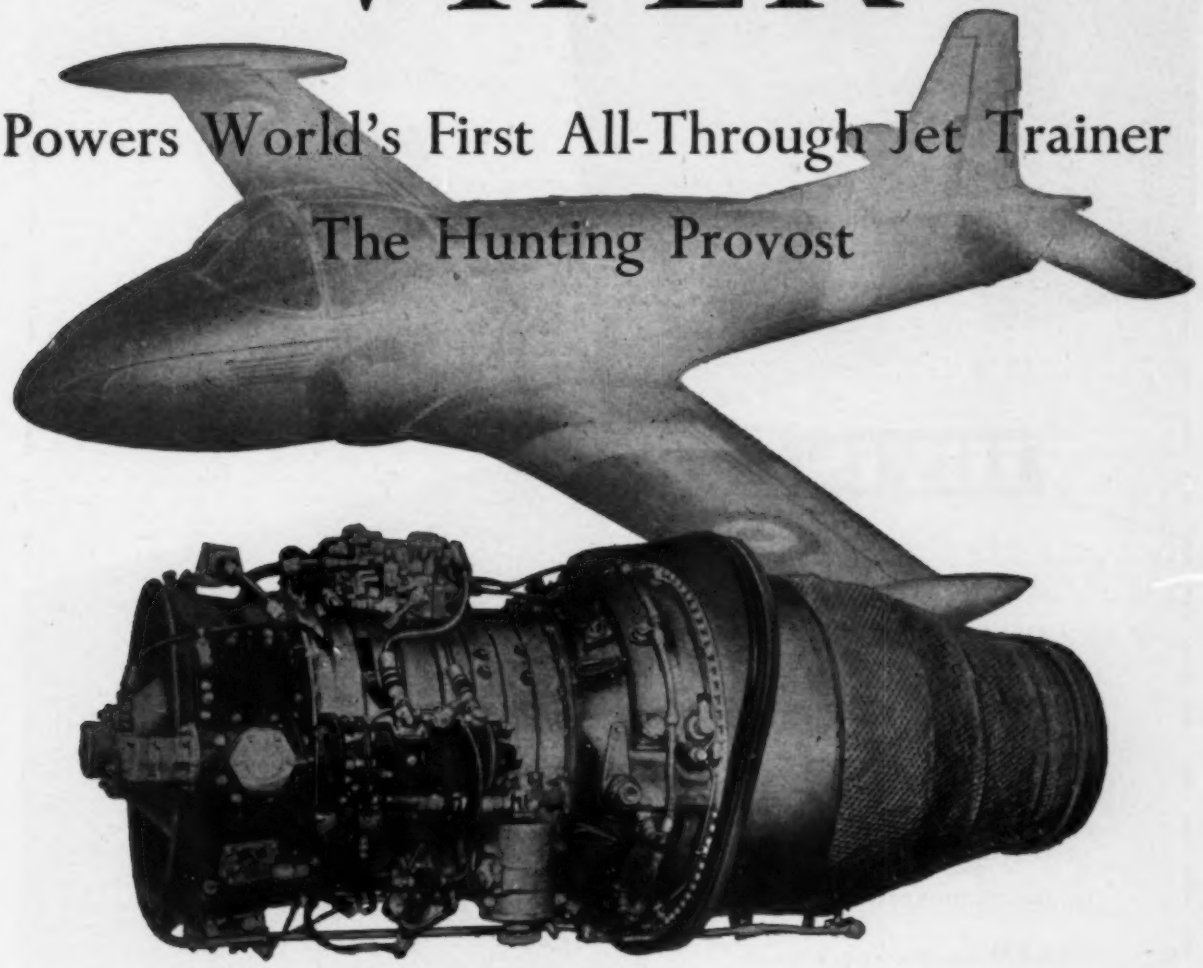


(Right) The Lucas MGTD fuel pump has a rated output of 2,600 gal/hr.

VIPER

Powers World's First All-Through Jet Trainer

The Hunting Provost



The decision of the Royal Air Force early in 1957 to pioneer 'all-through' jet training was made possible mainly by one fact; that there was in existence an aircraft and an engine which exactly met their requirements for the job — the Hunting Jet Provost powered by the Armstrong Siddeley Viper. Apart from the logic of 'all-through' jet training for jet age pilots, economy was an important factor in this new policy: and on this score the Viper's record passed scrutiny with flying colours. Here was an engine with a really high utilization rate — reliable, robust, easily serviceable. Today, Jet Provosts, powered by the Viper Mark 8 are now serving with the R.A.F.; their record under training conditions has been beyond reproach.

Bristol Siddeley

ENGINES LIMITED

... the missile must be recovered

IRVIN

SUPERSONIC

PARACHUTE RECOVERY SYSTEMS

The recovery of test vehicles is an essential part of the development and testing stages of guided missiles.

IRVIN-designed parachute-recovery systems have scored great successes in recent missile projects which entailed recovery of test vehicles from speeds in excess of Mach 1·5.

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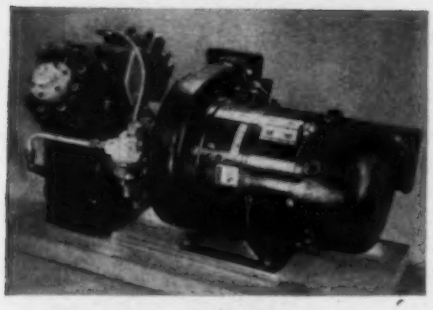
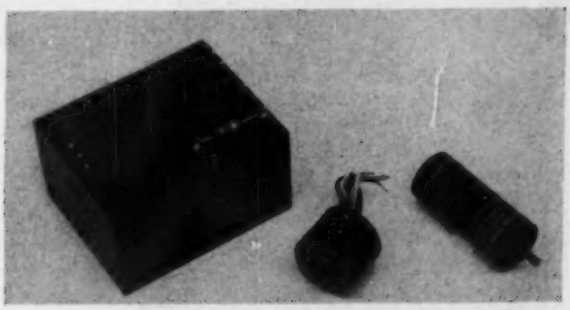
STAND NO. 283 SBAC EXHIBITION



(Left) Normalair six-ton vapour cycle unit.

(Right) Servo components by R. B. Pullin.



Accessory Manufacturers' Year.

have produced the type HOD pump and, for other applications, the HM.4 hydraulic motor and the P.60 unit which may function as either pump or motor. The seven-plunger HOD pump provides flows of up to 20 gal/min, operating at 3,500 r.p.m. and pressures in excess of 4,000 lb/sq in. The unit is about 10½in long, 7in wide and 7.8in high. The HM.4 motor is similar to the standard pump but has five plungers. It is available as either a fixed-stroke machine with pre-set camplate or with servo control for variable stroke operation. A refinement is an automatic speed control which operates if the alternator or frequency-control system should fail. The motor produces a rated output of 16 h.p., weighs 15¾ lb and measures 9.5in long, 4.5in wide and 7.5in high. The P.60 unit handles one gal/min per 1,000 r.p.m. (up to 6,000 r.p.m.) and the direction of rotation can be simply reversed. It weighs 3½ lb.

McMichael Radio, Ltd. A telemetry receiving system, type TDX 235, receives data signals from guided missiles in flight and records them photographically on film. Pulse signals are passed to a Histogram recorder where, together with a timing display, they appear on a C.R. tube for continuous photographing by a 35-mm camera. The receiving equipment incorporates its own test gear. McMichael also produce sonobuoys which on impact with the sea release a hydrophone on a 40ft cable, erect a radio aerial, switch on a transmitter and release the parachute. The operational endurance is not less than four hours.

Normalair, Ltd. A careful study of vapour cycle cooling techniques has led this company to offer both reciprocating and centrifugal units in systems of 6, 17 and 30 tons (equivalent weight of ice) refrigeration capacity. Centrifugal units can be driven by an electric motor, but an air turbine permits a substantial decrease in weight. In general, electrically-driven systems are used on aircraft where air recirculation is used. The company also manufactures a comprehensive range of cabin pressurization and control equipment for a number of aircraft types.

Palmer Aero Equipment, Ltd. The firm have produced the first entirely British-made dispersion polymer P.T.F.E. hydraulic hoses, which they are now marketing under the name of Palmer Fluoroflex. Swaged-on or reusable end fittings can be supplied. A new, lightweight electrical engine harness has also been developed.

Peto and Radford. A 24-volt aircraft battery, type 12-ECM.13-VA and a variant, the 12-ECE.13-VB, are fitted to the Viscount 800 series and the Comet 4. The cells are assembled in moulded containers of high-impact polystyrene and the cell vent plugs vent into a compartment on the top of the battery and are exhausted overboard through a pipe.

Plannair, Ltd. Equipment for several of Britain's latest aircraft has been developed by Plannair. The 9PL 241-274 axial flow blower, 16in long, 10½in diameter, is to be used for cabin air recirculation on the Vickers Vanguard; it has output of 1,300 cu ft/min at 8,000 r.p.m. Current consumption is 160 amp at the design point. A larger unit, delivering 5,500 cu ft/min was designed in collaboration with the Fairey Aviation Company, and is installed in each nacelle of the Rotodyne, where it cools the oil, the engine bay and electrical ancillaries. A further multi-stage compressor weighing 15 lb is used on the Blackburn NA.39 for generator cooling. It delivers 270 cu ft/min at 14,000 r.p.m. from a package 12in long and 6in diameter.

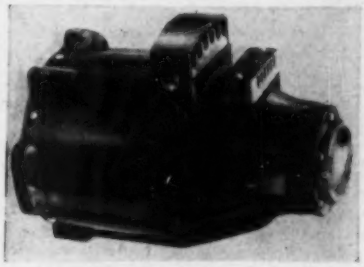
The Plessey Group of Companies. Both airborne and ground-to-air U.H.F. equipment is now manufactured by Plessey. The former is represented by a transmitter/receiver (type AN/ARC-52) manufactured under licence from Collins Radio Corporation but completely anglicized. It operates from power supplies of 27.5V D.C. or 115/200V, 400 c/s three-phase A.C., and the complete unit is supported on a special anti-vibration tray; as with the ground equipment, the AN/ARC-52 provides 1,750 channels. The range of U.H.F. equipment will work in conjunction with current U.H.F. apparatus anywhere in the world. Other equipment includes a radio teleprinter receiving terminal, F.S.K. transmitter drive unit and PTR.61 lightweight V.H.F. transmitter/receiver.

R. B. Pullin and Co., Ltd. Among a range of servocomponents, motor generators, transistorized amplifiers and magnetic amplifiers, the R.807 size 10 motor generator and the TA.1G servo-amplifier are both new developments. Advance data for the former indicates that it is a two-phase, 6 pole, 400 c/s precision servo motor with an integral damping generator that produces an output voltage linear with speed. It weighs 4.6 oz, has a maximum torque of 0.2 oz/in and an operating temperature range of −54 deg C to +85 deg C. The TA.1G servo amplifier provides the control phase power for the servo motor or for size 11 or 18 motors. It is totally immersed in opaque resin, weighs 11½ oz and needs no additional heat sink to operate in temperatures up to 50 deg C.

Pye Telecommunications, Ltd. Possibly the first application of transistors to airborne control equipment is a feature of the Pye overspeed and rotation indicator for the Rolls-Royce Conway. Warning of overspeeding is given by a flashing light on the pilot's or engineer's control panel. Still under final development, the indicator uses potted-component bricks and a printed circuit base, and the only moving part of the equipment is a small tacho-generator mounted on the engine.

Rotax, Ltd. Current developments at Rotax include constant frequency A.C. systems, brushless alternators, ram air turbo-alternators, transistorized inverters, magnetic amplifier applications and low pressure air starting. The Rotax rotating-rectifier, brushless alternator is an oil-cooled machine rated at 40 kVA. It weighs 87 lb, embodies silicon rectifiers and is intended to be constant-speed driven at 8,000 r.p.m., although it can be used on variable speed systems. Over 4,000 hr running have now been logged. The ram-air turbo alternator comprises a 16in diameter nacelle housing a 15 kVA, 400 c/s alternator driven by a 14-blade turbine. It is intended as an emergency power supply and under steady load runs at 8,000 r.p.m. ±5 per cent. It weighs 67½ lb.

The company are now working upon a single and three-phase 115 V or 150 VA output transistorized inverter. A limitation

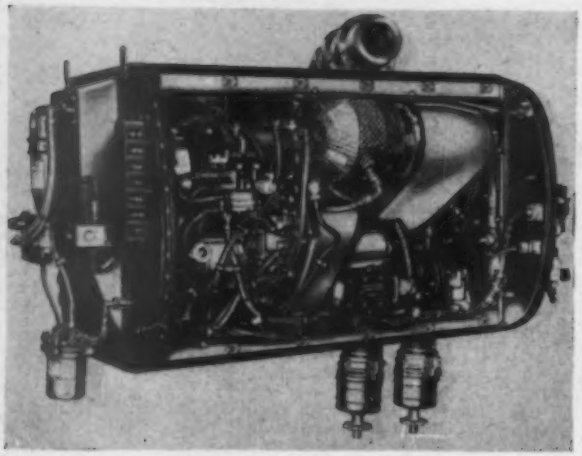


Rotax 40 kVA brushless alternator.

is that suitable power transistors have still to be obtained from the U.S.A. but it is hoped that British equipment will be available in the new year.

Another development is an electrically energized particle magnetic clutch for use in servo control systems where torque control is required. When the current supply is broken 100 per cent slip occurs and the flux in the particles can be closely controlled by varying the current. Two units are included in the range, one with an output torque of 7½ lb/ft and another with a torque of 5 lb/ft over the same speed range. Weights are 9 lb and 7 lb respectively. Of the range of low pressure air starters one of the latest is for gas turbine engines with an inertia of 500 lb ft². Time to 2,500 r.p.m. against 475 lb ft² inertia is 15-20 secs. A peak horse power of 70 b.h.p. is developed.

Rover Gas Turbines, Ltd. This branch of the famous motor car company has recently produced an airborne gas turbine driven auxiliary power unit. For emergency electrical supply purposes it is coupled to a 32 kW Rotax 208 V three-phase 400 c/s alternator which it drives



Accessory Manufacturers' Year...

(Left) The Rover Gas Turbines airborne auxiliary power unit.

(Right) Venner lightweight accumulators (silver-zinc, resin-sealed) for missile and other applications.

through reduction gearing. The gas turbine revolves at 46,000 r.p.m. If A.P.U. engine starting is required, air can be tapped from a bleed valve in the top panel of the unit and fed to low pressure air starters on the main engines. The A.P.U. is started by either electric motor or cartridge. Dimensions are 52.8in long, 23.8in wide, 37.6in high, and the weight is 400 lb. At I.S.A. temperature and pressure, air bleed flow is about 550 cu ft/min.

Skyhi, Ltd. Four new jacks have appeared from Skyhi this year: a heavy duty tripod wing jack of 30 tons or more capacity, with electrical, pneumatic or manual standby operation; a twin wheel-change double ram jack with a capacity of 180,000 lb; a similar 30-ton jack with a hydraulic lift of 12in and a three ton double-ram tripod jack, particularly suited to helicopters or lightweight fighters. The hydraulic lift of the latter is 23in.

Simmonds Aerocessories, Ltd. Another application of transistors is to be found in this company's Pacitran fuel contents gauge, a transistorized development of the Pacitor capacitance unit manufactured by Firth Cleveland Instruments, Ltd. A recent application of the unit is for measuring the contents of liquid oxygen containers. Where aircraft fuels are measured the scale is calibrated in mass units and fuel density correction is achieved by a force balance float device and an immersed sensing unit to detect changes in the dielectric constant.

Saunders Valve Co., Ltd. A Mark 4 version of the Saunders spherical plug valve is now being introduced, the chief refinment over earlier designs being the use of a thin rubberized fabric seat diaphragm. A prototype valve has already exceeded 1.5 million open-shut-open cycles at a pressure of 60 lb/sq in without leaking and the torque is still within permissible limits.

Sperry Intraview recorder.

Sperry Gyroscope Co., Ltd. Sperry are continuing this year with the development of their design philosophy for integrated controls and an integrated instrument system for high performance aircraft. They are now also able to reveal some of their work in the development of the Armstrong Whitworth Seaslug guided weapon. The company's contribution has extended to ship-borne test equipment for the weapon system. A new product of the firm, marketed under licence from I.C.I., is the Introview flaw detector, for rapid non-destructive testing of non-ferrous tubes and for in-service and inspection applications. A trace on a recorder unit is obtained from an eddy current probe.

Standard Telephones and Cables, Ltd. Reductions in size, weight and power consumption have followed the wide adoption of transistors and printed circuits. New this year are a comprehensive V.H.F./I.L.S./V.O.R. airborne communication and navigation aid STR.23/34/35/36, the SA.10 audio control and intercommunication equipment, a frequency modulated sub-miniature radio altimeter and a four-channel airborne radio teleprinter, all of which are examples of transistor engineering. Substantial savings in size and weight have been achieved.

Teddington Aircraft Controls, Ltd. Where products are developed with particular applications in view, only limited use is served by quoting details of each individual design. This company produce a very wide range of control equipment and specialize in pneumatic and electric operation. In parallel with other manufacturers of electrical equipment, Teddington are now making increasing use of transistors; a temperature controller measuring 2in by 2½in embodying a transistor amplifier is perhaps typical of their new products.

Tecalemit, Ltd. Even apparently firmly-established equipment is subject to change, and Tecalemit have this year introduced a high-pressure nylon delivery tube for their hand guns. Another member of the organization is Foamite, Ltd., who are manufacturing the Fireball, a 150 lb dry-chemical mobile extinguisher. Two small fire engines, mounted on Austin Gypsy chassis, are a further fire-fighting development.

Transport Seating, Ltd. New on the aircraft seating scene, this Birmingham firm are producing double and triple seats for the AW.650 Argosy. They recline into three positions, are stressed for 9G and fold sideways against the fuselage wall when not required. Excluding folding tables, the triple seat (56in wide, 45in high and with a seat width of 16in) weighs 68½ lb.

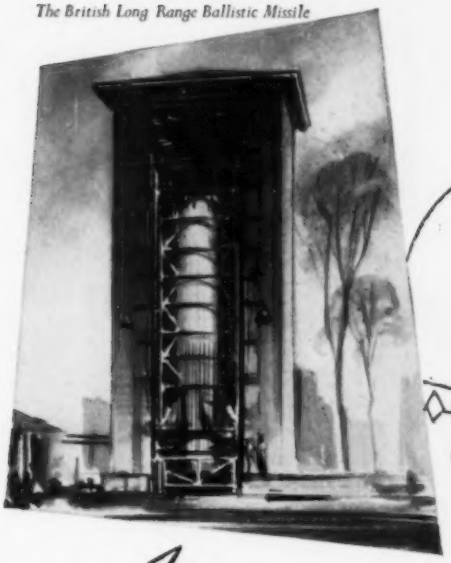
Triplex, Ltd. A recent development in this company's work upon laminated windscreens is the curved design adopted on the Valiant. Clear gold-film heated screens, dissipating up to 1,000 watts per square foot and with built-in thermostat control, are being supplied to Vickers for the Vanguard and to de Havilland for the Comet 4.

Venner Accumulators, Ltd. The latest product of this firm is a resin-sealed battery, type HT.125, which requires no topping up and no maintenance. Of the silver-zinc type, it has a nominal capacity of 0.125 amp hr for discharge over a range of 10 to 500 milliamps.

Westinghouse Brake and Signal Co., Ltd. This firm has now turned its attention to the field of semi-conductors. Products include selenium rectifiers for aircraft power supplies, high temperature lightweight selenium rectifiers for H.T. supplies, and magnetic amplifier circuits. Copper-oxide units for instrument and telecommunication applications and the latest type of germanium and silicon diodes are recent advances, while selenium and germanium rectifier equipment for the aircraft and other industries needing reliable sources of D.C. power are also made.

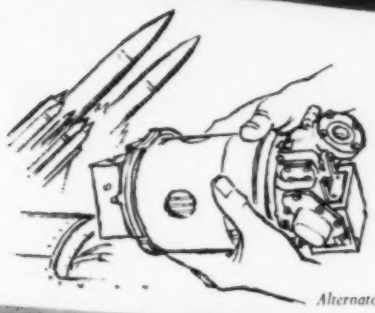
Transport Seating, Ltd., triple chair for A. W. Argosy.

The British Long Range Ballistic Missile



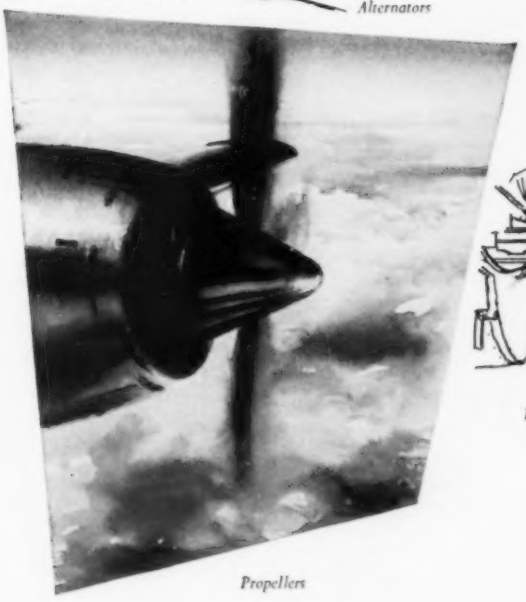
Plastics

Air-Conditioning Equipment



Alternators

DH PROPELLERS



Propellers

Radar Scanners

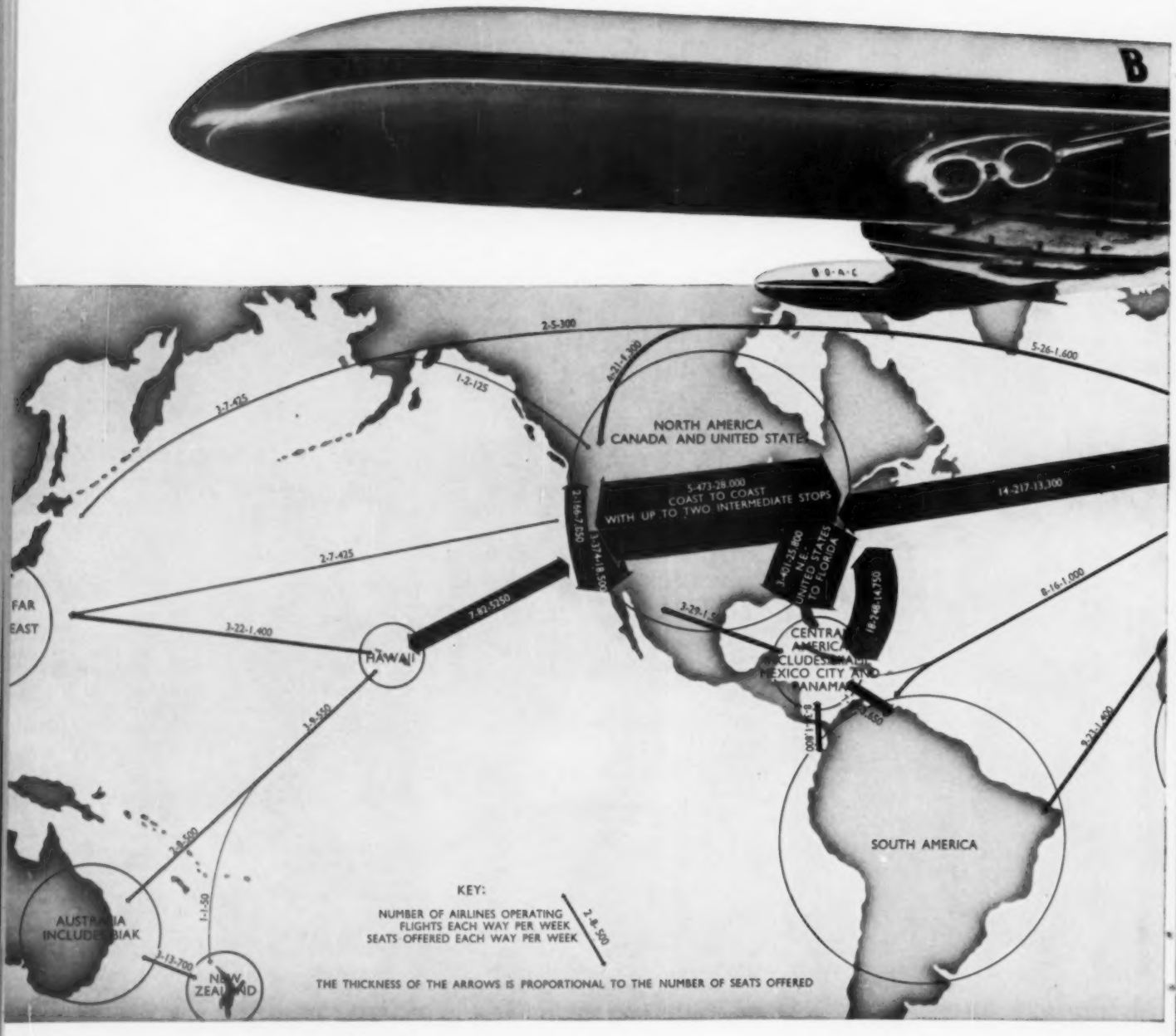
The Firestreak Guided Missile

A major member of a world-wide Enterprise — manufacturers of a wide range of products to meet the needs of military and civil aviation — backed by more than twenty years of experience in the design, development and production of high-precision equipment.

DE HAVILLAND PROPELLERS LIMITED

HEAD OFFICE: HATFIELD, HERTFORDSHIRE, ENGLAND

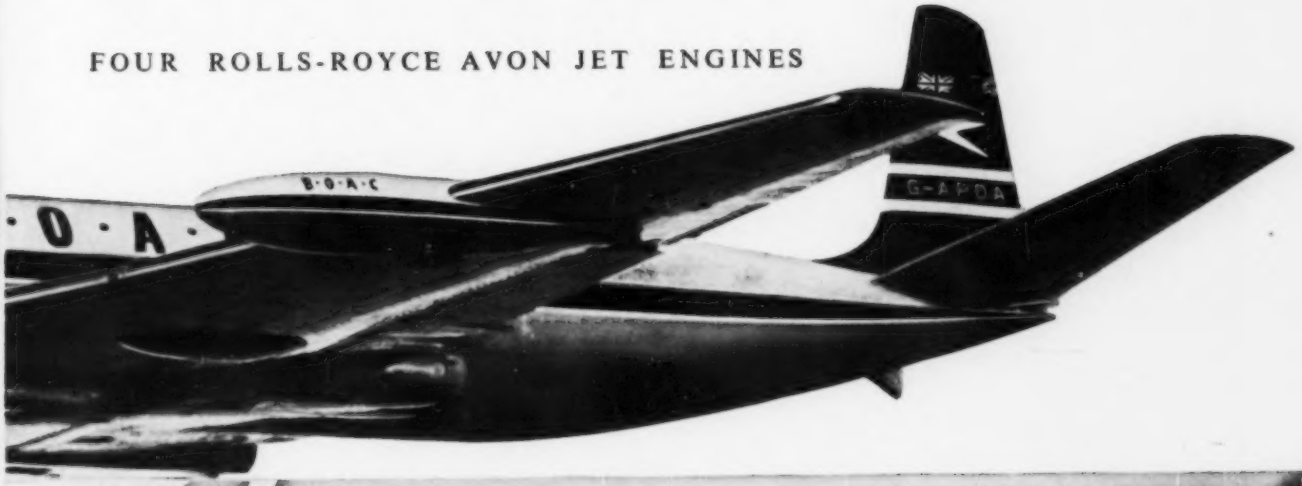
THE COMET 4

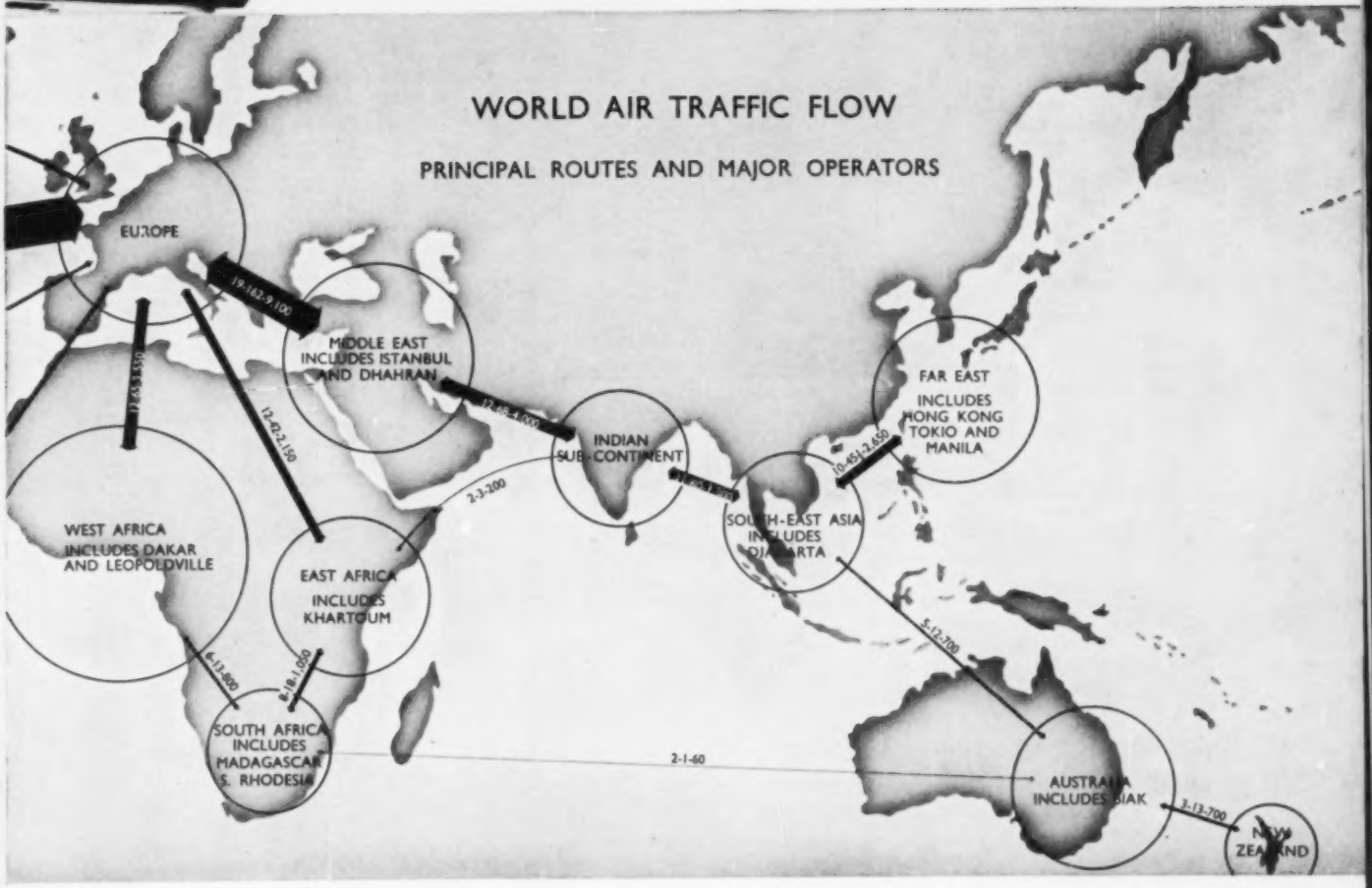


Specifically designed to pay its way on short and long route sectors of moderate traffic density
i.e. nearly every airway in the world

D E

FOUR ROLLS-ROYCE AVON JET ENGINES



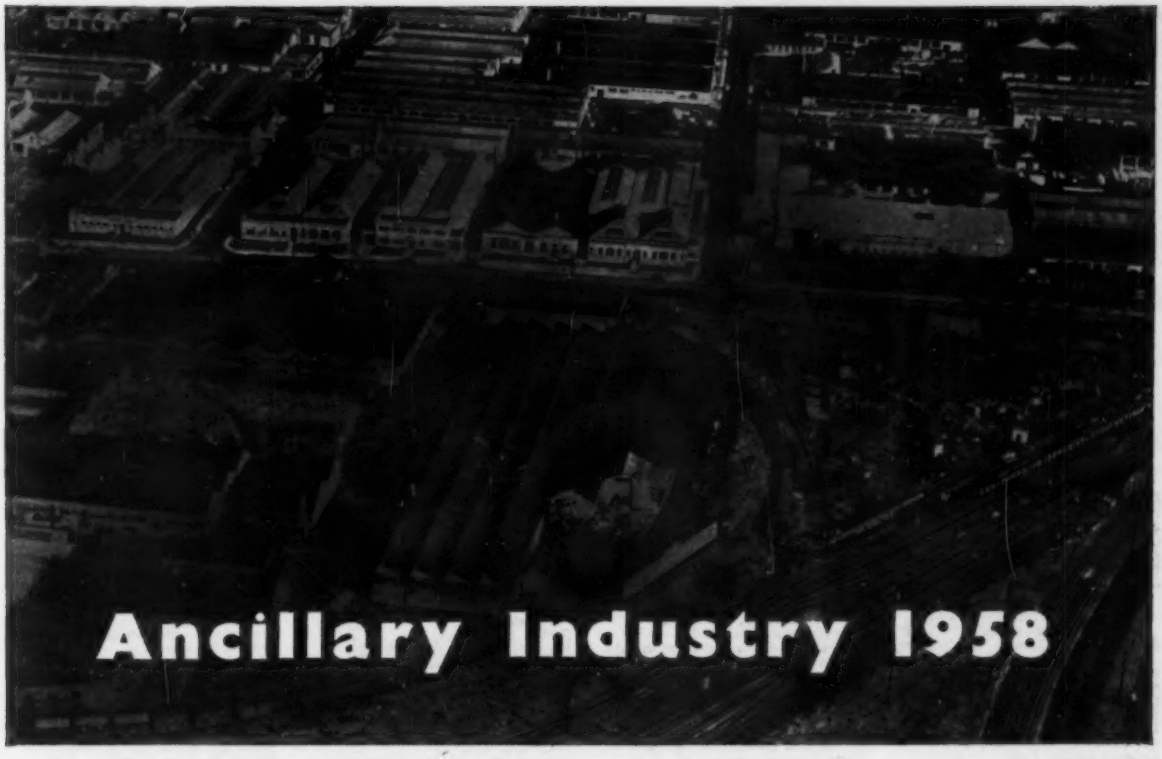


HAVILLAND

HIGH-PERFORMANCE TURBOJETS
LIQUID-PROPELLENT ROCKETS
SHAFT TURBINES
PISTON ENGINES
NUCLEAR POWER
RESEARCH AND DEVELOPMENT

THE DE HAVILLAND
ENGINE COMPANY LIMITED

HEAD OFFICE: LEAVESDEN HERTFORDSHIRE ENGLAND
MEMBER OF THE DE HAVILLAND WORLD-WIDE ENTERPRISE



Ancillary Industry 1958

"FLIGHT" READY-REFERENCE DIRECTORY TO PRODUCTS AND FIRMS

IN this special directory section of "Flight" over 400 components, accessories, services, etc., are listed in quick-reference form, and under the headings are names of nearly 600 United Kingdom firms whom we understand to be manufacturers or suppliers of such items. Their addresses, with telephone numbers and telegraphic registrations, are given alphabetically at the end of the products directory. Aircraft, engines and missiles are dealt with in the special reviews earlier in this issue, as are new developments in certain classes of major equipment. "Aerial work" operations are not included; they have their place in others of our special numbers.

A.G.S. PARTS

Abbey Panel and Sheet Metal Co., Ltd., The
Acton Bolt, Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
Aerocontacts (Sales), Ltd.
Aero Controls, Ltd.
Aircraft Materials, Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Amal, Ltd.
Aviation Developments, Ltd.
Aylesbury Turned Parts (True Screws), Ltd.
Bretts Precision Engineering Co., Ltd.
Brown Brothers (Aircraft), Ltd.
Coin Insulation, Ltd.
Coopers Mechanical Joints, Ltd.
Curd Components, Ltd.
Dowty Seals, Ltd.
Dundas, Ltd., R. K.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Firth Cleveland Instruments, Ltd.
Guest, Keen and Nettlefolds (Midlands), Ltd.
Hickman, Ltd.
High Pressure Components, Ltd.
Kautex, Ltd.
King Aircraft Corporation
Lancefield Aircraft Components, Ltd.
M.H.H. Engineering Co., Ltd.
Miller Aviation, Ltd.
Newton and Co., H. T.
Newton and Co., Ltd., L. H.
Page Engineering Co.
Pearson Brothers (Engineers), Ltd.
Powis and Sons, Ltd., David
R.M.R. Engineering
Ross, Courtney and Co., Ltd.
Rubery, Owen and Co., Ltd.
Scottish Distributors, Ltd.
Simmonds Aerocessories, Ltd.
Sky-Lines (Aircraft Components), Ltd.
Spa Guilds, Ltd.
Spencer Moulton and Co., Ltd., George
Spring Washers, Ltd.
Stone and Co. (Deptford), Ltd., J.
Terry and Sons, Ltd., Herbert
Torrington Co., Ltd., The
Tucker Eyelet Co., Ltd., Geo.
Whitehouse Industries, Ltd.
Y.S.C., Ltd., The

ABRASIVES

Eagle Aircraft Services, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.

ACCUMULATORS, HYDRAULIC

Dowty Equipment, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Fawcett, Preston and Co., Ltd.
Fireproof Tanks, Ltd.
H.M.I. (Engineering), Ltd.
Hobson, Ltd., H. M.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Reynolds Tube Co., Ltd.
Walter, A. J.

ACTUATORS

Aero Controls, Ltd.
Airline Air Spares, Ltd.
Bell Precision Engineering Co., Ltd.
Dowty Nucleonics, Ltd.
Dunlop Rubber Co., Ltd. (Av. Div.)
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd.
Fairey Aviation Co., Ltd., The
General Electric Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Graseby Instruments, Ltd.
Hercules Engineering Co., Ltd., The
Hobson, Ltd., H. M.
Hymatic Engineering Co., Ltd., The
M. L. Aviation Co., Ltd.
Miles, Ltd., F. G.
Newmark, Ltd., Louis
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Scottish Distributors, Ltd.
Sperry Gyroscope Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Vernons Industries, Ltd.
Western Mfg. (Reading), Ltd.
Wilmot Breeden, Ltd.

ADHESIVES

Aircraft Materials, Ltd.
B. B. Chemical Co., Ltd.
Bakelite, Ltd.
Baxter, Woodhouse and Taylor, Ltd.
CIBA (A. R. L.), Ltd.
Cox and Son, Ltd., John
Docker Brothers
Dundas, Ltd., R. K.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
Imperial Chemical Industries, Ltd.
Kane, Ltd., Douglas
Kautex, Ltd.
Midland Silicones, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Surridge's Patents, Ltd.
Titanine, Ltd.

AERIALS (AIRCRAFT RADIO, ETC.) AND EQUIPMENT

Aerocontacts (Sales), Ltd.
Astralux, Ltd.
Belling and Lee, Ltd.
Chelton (Electrostatics), Ltd.
Cossor Radar and Electronics, Ltd.
Decca Navigator Co., Ltd., The
E.M.I. Electronics, Ltd.
Eagle Aircraft Services, Ltd.
Ecko Electronics, Ltd.
Fairey Aviation Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Lancefield Aircraft Components, Ltd.
McMichael Radio, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Racal Engineering, Ltd.
Sanders (Electronics), Ltd., W. H.
Scottish Distributors, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

AGENTS, AIRCRAFT

Aerocontacts (Aircraft Distributors), Ltd.
Airline Air Spares, Ltd.
Airwork, Ltd.
Dundas, Ltd., R. K.
Eagle Aircraft Services, Ltd.
Hants and Sussex Aviation, Ltd.
Helicopter Sales, Ltd.
Irish Air Charter, Ltd.
Newton and Co., H. T.
Rollason Aircraft and Engines, Ltd.
Travelair, Ltd.
Whittemore (Aeradio), Ltd., A. J.

ANCILLARY INDUSTRY 1958...

Insulation jacket for silencer of Vickers Vanguard air-conditioning system (Bell's Asbestos and Engineering, Ltd.).

AGRICULTURAL AVIATION EQUIPMENT
Delaney Gallay, Ltd.
Fireproof Tanks, Ltd.
Fison-Airwork Ltd.
Gloster Technical Developments
Hants and Sussex Aviation, Ltd.
Newton and Co., H. T.
Saunders Valve Co., Ltd.

AIR CONDITIONING AND PRESSURIZATION EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Avica Equipment, Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Bell's Asbestos and Engineering, Ltd.
Boorn and Co., Ltd., Thomas
British Oxygen Aro Equipment, Ltd.
de Havilland Propellers, Ltd.
Delaney Gallay, Ltd.
Dragonair, Ltd.
Dunlop Rubber Co., Ltd. (Av. Division)
Eagle Aircraft Services, Ltd.
Exactor, Ltd.
Frankenstein and Sons (Manchester), Ltd., F.
General Electric Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Godfrey and Partners, Ltd., Sir George
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
Kingston Instrument Co., Ltd.
M. L. Aviation Co., Ltd.
Newton and Co., H. T.
Normalair, Ltd.
Plannair, Ltd.
Rollason Aerocessories, Ltd.
Saunders Valve Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Stone and Co. (Deptford), Ltd., J.
Teddington Aircraft Controls, Ltd.
Westminster Airways Servicing, Ltd.

AIR TRAFFIC CONTROL SERVICES AND EQUIPMENT
Airmed, Ltd.
Aldis Brothers, Ltd.
Cossor Radar and Electronics, Ltd.
Decca Navigator Co., Ltd., The
Decca Radar, Ltd.
General Electric Co., Ltd., The
International Aeradio, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Newton and Co., Ltd., H. T.
Plessey Co., Ltd., The
Royston Instruments, Ltd.
Standard Telephones and Cables, Ltd.
Thermionic Products, Ltd.
Whittemore (Aeradio), Ltd., A. J.

AIRFIELD CONSTRUCTION
BP Trading, Ltd.
Costain, Ltd., Richard

AIRFIELD CONSTRUCTION EQUIPMENT
Aero Maintenance Equipment, Ltd.
Aerocontacts (Ground Equipment), Ltd.
Clapham Park Motors, Ltd.
Reliance Cords and Cables, Ltd.
Wayne Tank and Pump Co., Ltd.

AIRFIELD MANAGEMENT
Airwork, Ltd.
British Aviation Services (Engineering), Ltd.
Derby Aviation, Ltd.
International Aeradio, Ltd.

AIRSCREWS—see Propellers

ALLOYS, FERROUS
Aircraft Materials, Ltd.
Birkett, Billington and Newton, Ltd.
Brown Bayley Steels, Ltd.
Brown Brothers (Aircraft), Ltd.
Carlisle and Co., Ltd., C. G.
Eagle Aircraft Services, Ltd.
Firth-Vickers Stainless Steels, Ltd.
Flather, Ltd., W. T.
Jessop and Sons, Ltd., William
Habershon and Sons, Ltd., J. J.
Hadfields, Ltd.
Kent Alloys, Ltd.
Macready's Metal Co., Ltd.
Park Gate Iron and Steel Co., Ltd.
Phosphor Bronze Co., Ltd., The
Rapp, Ltd., Leo
Steel, Peech and Tozer, Ltd.
Telegraph Construction and Maintenance Co., Ltd., The
Willan, Ltd., G. L.

ALLOYS, FUSIBLE
Eagle Aircraft Services, Ltd.
Metachemical Processes, Ltd.
Mining and Chemical Products, Ltd.

ALLOYS, HEAVY
Birkett, Billington and Newton, Ltd.
Brown Brothers (Aircraft), Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Heckford, Ltd., Arthur E.
Stone and Co. (Charlton), Ltd., J.
Willan, Ltd., G. L.

ALLOYS, LIGHT
Aircraft Materials, Ltd.
Birkett, Billington and Newton, Ltd.
Birmetals, Ltd.
Boorn and Co., Ltd., Thomas
Booth and Co., Ltd., James
British Aluminium Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Eagle Aircraft Services, Ltd.
High Duty Alloys, Ltd.
Imperial Chemical Industries, Ltd.
Kent Alloys, Ltd.
Mills, Ltd., William
Northern Aluminium Co., Ltd.
Rapp, Ltd., Leo
Reynolds T. I. Aluminium, Ltd.
Rollett and Co., Ltd., H.
Sky-Lines Aircraft Components, Ltd.
Southern Forge, Ltd.
Stone and Co. (Charlton), Ltd., J.

ALTERNATORS
British Thomson-Houston Co., Ltd.
de Havilland Propellers, Ltd.
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd.
General Electric Co., Ltd., The
Hobson, Ltd., H. M.
Newton Brothers (Derby), Ltd.
Newton and Co., H. T.
Rotax, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Vernons Industries, Ltd.
Whittemore (Aeradio), Ltd., A. J.

ALUMINIUM
Aluminium Corporation, Ltd.
Attewell and Sons, Ltd., B.
Birkett, Billington and Newton, Ltd.
Birmetals, Ltd.
Booth and Co., Ltd., James
British Aluminium Co., Ltd., The
British Insulated Callender's Cables, Ltd.
Eagle Aircraft Services, Ltd.
Hard Aluminium Surfaces, Ltd.
Imperial Chemical Industries, Ltd.
Mills, Ltd., William
Northern Aluminium Co., Ltd.
Rapp, Ltd., Leo
Reynolds T. I. Aluminium, Ltd.
Rollet and Co., Ltd., H.
Sky-Lines Aircraft Components, Ltd.
Southern Forge, Ltd.
Sterling Metals, Ltd.
Stone and Co. (Charlton), Ltd., J.
Wilson and Sons (London), Ltd., W.

ARMAMENT (GUNS) AND COMPONENTS
Dunlop Rubber Co., Ltd. (Aviation Division)
French and Sons, Ltd., Thomas
Hercules Engineering Co., Ltd., The
Martin-Baker Aircraft Co., Ltd.
Newton and Co., H. T.
Stewart Aeronautical Supply Co., Ltd.

ARMAMENT (OTHER THAN GUNS) AND COMPONENTS (see also Guided-weapon equipment)
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Boulton Paul Aircraft, Ltd.
Dunlop Rubber Co., Ltd. (Aviation Division)
E.M.I. Electronics, Ltd.
Ferranti Meters, Ltd., Denis
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
M.L. Aviation Co., Ltd.
Microcell, Ltd.
Portsmouth Aviation, Ltd.
Specto, Ltd.

ASBESTOS AND ASBESTOS COMPONENTS (see also Refractory Materials)
Bell's Asbestos and Engineering, Ltd.
Coin Insulation, Ltd.
Eagle Aircraft Services, Ltd.
Miles, Ltd., F. G.
Turner Brothers Asbestos Co., Ltd.
Walker and Co., Ltd., James
Wills Pressure Filled Joint Ring, Ltd.

ASSEMBLIES, MAJOR AIRFRAME
Abbey Panel and Sheet Metal Co., Ltd., The
Aerocontacts (Aircraft Distributors), Ltd.
Airline Air Spares, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineering), Ltd.
Bristol Aircraft, Ltd.
Boulton Paul Aircraft, Ltd.
Brooklands Aviation, Ltd.
Cornercroft, Ltd.
Eagle Aircraft Services, Ltd.
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Fairey Aviation Co., Ltd., The
Flight Refuelling, Ltd.
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Redwing, Ltd.
Rollason Aerocessories, Ltd.
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Saunders-Roe, Ltd.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.

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Aero Maintenance Equipment, Ltd.
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Airmed, Ltd.
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Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
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Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
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Jig Design and Engineering Co., Ltd.
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Blackburn and General Aircraft, Ltd.
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Fairey Aviation Co., Ltd., The

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Newton and Co., H. T.
Vane and Co., A. H.

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Eagle Aircraft Services, Ltd.
Elliot Equipment, Ltd.
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Fireproof Tanks, Ltd.
R.F.D. Co., Ltd.

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Eagle Aircraft Services, Ltd.
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Aerocontacts (Sales), Ltd.
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Newton and Co., H. T.
Oldham and Son, Ltd.
Peto and Radford.
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Varley Dry Accumulators, Ltd.
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Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
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Silentbloc, Ltd.
Stone and Co. (Charlton), Ltd., J.
Wellworthy, Ltd.
Yorkshire Engineering Supplies, Ltd.

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Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Fischer Bearings Co., Ltd.
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Ransome and Marles Bearing Co., Ltd.
Skefco Ball Bearing Co., Ltd., The
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.

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Eagle Aircraft Services, Ltd.
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Fischer Bearings Co., Ltd.
Newton and Co., H. T.
Ransome and Marles Bearing Co., Ltd.
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Skefco Ball Bearing Co., Ltd., The
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Eagle Aircraft Services, Ltd.
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Hines (Engineers), Ltd., Edward
Newton and Co., H. T.
Vaughan and Co., Ltd., Edgar

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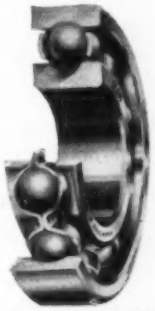

Ransome and Marles ball bearing.

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Harringay Photo Supplies
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Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
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Vosper, Ltd.

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Field Aircraft Services, Ltd.
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Birkett, Billington and Newton, Ltd.
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Napier and Son, Ltd., D.
Northern Aluminium Co., Ltd.
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Vosper, Ltd.

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Firth and John Brown, Ltd., Thos.
Firth-Vickers Stainless Steels, Ltd.
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Jessop and Sons, Ltd., William
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Napier and Son, Ltd., D.
Phosphor Bronze Co., Ltd.
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Telegraph Construction and Maintenance Co., Ltd., The
Vosper, Ltd.
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Ross, Ltd., S. Grahame
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Aerogalley

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Plessey Co., Ltd., The

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Renold Chains, Ltd.

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General Electric Co., Ltd., The
Newton and Co., H. T.

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Ross, Ltd., S. Grahame
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Sky-Lines Aircraft Components, Ltd.
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Baxter, Woodhouse and Taylor, Ltd.
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Flint, Ltd., Howard
Frankenstein and Sons (Manchester), Ltd., P.
Ilford, Ltd.
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Newton and Co., H. T.
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Siebe, Gorman and Co., Ltd.

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Rapp, Ltd., Leo

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Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Redifon, Ltd.
Siemens Edison Swan, Ltd.
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Thorn Electrical Industries, Ltd.
Ultra Electric, Ltd.
W.S. Electronics (Production), Ltd.
Whittemore (Aeradio), Ltd., A. J.

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Hadfields, Ltd.
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Parnall and Co., Ltd., George
Pearson Brothers (Engineers), Ltd.
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Pipework and Engineering (Bristol), Ltd.
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Rivers, Ltd., A. E.
Rollason Aerocessories, Ltd.
Royston Industries, Ltd.
Rubery, Owen and Co., Ltd.
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Saunders-Roe, Ltd.
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Skyways, Ltd.
Spa Guilds, Ltd.
Vernons Industries, Ltd.
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Brooklands Aviation, Ltd.
Brown Brothers (Aircraft), Ltd.
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Ferranti (Meters), Ltd., Denis
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French and Sons, Ltd., Thomas
General Electric Co., Ltd., The
Gloster Aircraft Co., Ltd.
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Miles, Ltd., F. G.
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Parman Aircraft Supplies, Ltd.
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Rotax, Ltd.
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Scottish Distributors, Ltd.
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Soundrite, Ltd.
Specto, Ltd.
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Stewart Aeronautical Supply Co., Ltd.
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Technograph Printed Circuits, Ltd.
Thorn Electrical Industries, Ltd.
Western Mfg. (Reading), Ltd.
Westinghouse Brake and Signal Co., Ltd.
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Z and I Aero Services, Ltd.

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Aeroplastics, Ltd.
Airwork, Ltd.
Amphenol (Great Britain), Ltd.
Andec, Ltd.
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Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Bell Precision Engineering Co., Ltd.
Belling and Lee, Ltd.
Bradley, Ltd., G and E.
Bristol Aircraft, Ltd.
British Thomson-Houston Co., Ltd.
Brown Brothers (Aircraft), Ltd.
Cathodeon, Ltd.
Cinetra Manufacturing Co., Ltd.
Coin Insulation, Ltd.
Dobbie McInnes, Ltd.
E. R. S. (London), Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
Firth Cleveland Instruments, Ltd.
Kent, Ltd., George
Ketay, Ltd.
Miles, Ltd., F. G.
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Newmark, Ltd., Louis
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Parman Aircraft Supplies, Ltd.
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Savage, Ltd., W. Bryan
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Sky-Lines Aircraft Components, Ltd.
Soundrite, Ltd.
Specto, Ltd.
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Standard Telephones and Cables, Ltd.
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Straight-Lite Reflectors, Ltd.
Tecalemit, Ltd.
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Aylesbury Turned Parts (True Screws), Ltd.
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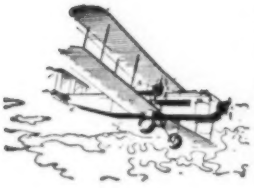
Bell Precision Engineering Co., Ltd.
Bramah and Co., Ltd., J. R.
Bretts Precision Engineering Co., Ltd.
Bristol Aircraft, Ltd.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Brown, Ltd., S. G.
Centrax, Ltd.
Delaney Gallay, Ltd.
Dobbie McInnes, Ltd.
Eagle Aircraft Services, Ltd.
Exactor, Ltd.
Goulder and Sons, Ltd., J.
Hadfields, Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Jig Design and Engineering Co.
Keim Engineering, Ltd.
Kelston Engineering Co., Ltd.
Kingston Instrument Co., Ltd.
Laycock Engineering, Ltd.
Leytonstone Jig and Tool Co., The
London Production Tools, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Newton and Co., H. T.
Oil Feed Engineering Co., Ltd.
Pearson Brothers (Engineers), Ltd.
Phillips and White, Ltd.
Pipework and Engineering (Bristol), Ltd.
Plessey Co., Ltd., The
Presland and Partners, Ltd.
Rivers, Ltd., A. E.
Rotol, Ltd.
Samlesbury Engineering, Ltd.
Sky-Lines Aircraft Components, Ltd.
Spa Guilds, Ltd.
Wilmot Breeden, Ltd.
Woodside Die Sinking Co., Ltd.
Yorkshire Engineering Supplies, Ltd.

ADDRESSES OF COMPANIES: pages 374-380

Meet the New ARGOSY!

THE WORLD'S FIRST TURBOPROP FREIGHTERCOACH TAKES ON A GREAT NAME IN CIVIL AVIATION



In the story of British aeronautical achievement, some great names stand out: aircraft that made their mark in the skies and helped to further aviation progress.

Such a name is the ARGOSY—the first civil aircraft built by Sir W. G. Armstrong Whitworth Aircraft Ltd., back in 1926. It made history as the first commercial aircraft to pay its way for an airline, and inaugurated Imperial Airways' famous Silver Wing lunch-time service between London and Paris. Economic operations were made possible by its trouble-free maintenance, reliability and carrying capacity.

The new turboprop ARGOSY, to make its first flight by the end of the year, is the jet-age successor of its famous namesake. And like the old ARGOSY, the Freightercoach (designated the AW650) will open a new era in air transportation. It is a most versatile aircraft. Not only can it carry up to 80 passengers in pressurised comfort at a speed of 300 miles an hour, it will also open a vast new market in air freight.

The modern ARGOSY carries over three times the load of a Dakota at twice the speed and half the cost.

PERFORMANCE

POWER: 4 Rolls-Royce Darts
AIRCRAFT CRUISING SPEED: (14,000 r.p.m.) 296 m.p.h.
MAXIMUM PAYLOAD: 27,000 lb.
RANGE WITH 20,000 lb. PAYLOAD: 1,600 st.m.
SIZE OF HOLD: 46 ft. 8 in. (14.23 m.) x 10 ft. (3.05 m.); floor area 426 sq. ft. (39.6 sq. m.).

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD., Baginton, Coventry, England
Member of Hawker Siddeley / One of the World's Industrial Leaders

The *Argosy* — BRINGS THE COST OF AIR FREIGHT DOWN TO EARTH

AT IDLEWILD AIRPORT

In the Departure Lounge of the B.O.A.C. at Idlewild International Terminal, New York. Connolly Leather is used for the wall panelling and the furniture.

IN THE AIR AND ON THE GROUND Connolly Leather serves the Aircraft Industry. Whether it is for furnishing airport buildings or furnishing aircraft cabins Connolly's attractive colour range has an immediate appeal. Furthermore, the freshness of the colour is retained through years of wear. That is why Connolly Leather distinguishes itself in any setting.

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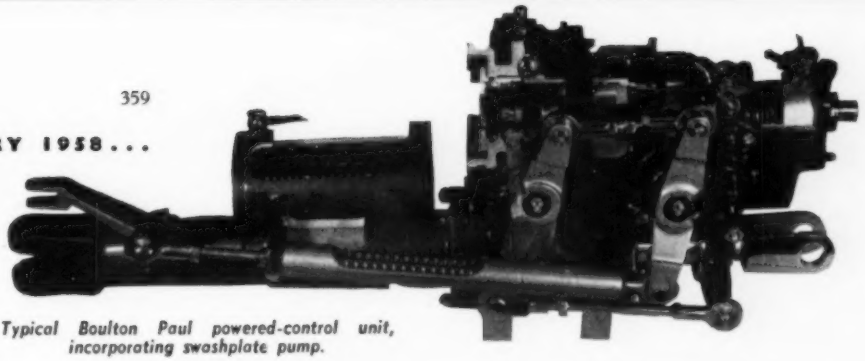
CONNOLLY BROS. (CURRIERS) LIMITED

CHALTON STREET · EUSTON ROAD · LONDON N.W.1 Telephone: EUSton 1661-5

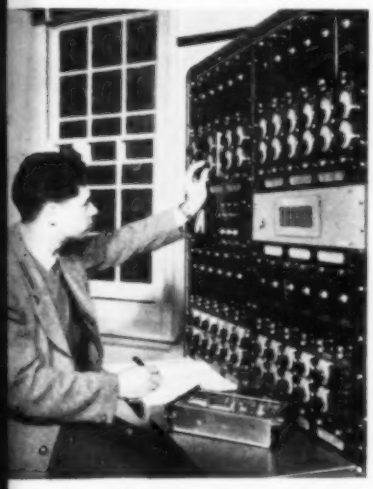
ANCILLARY INDUSTRY 1958...



Typical Boulton Paul powered-control unit, incorporating swashplate pump.

COMPONENTS, GAS-TURBINE SHEET METAL
Abbey Panel and Sheet Metal Co., Ltd., The
Bramah and Co., Ltd., J. R.
British Refrasil Co., Ltd., The
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Cornercroft, Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Morfax, Ltd.
Pipework and Engineering (Bristol), Ltd.
Samlesbury Engineering, Ltd.
Sankey and Sons, Ltd., Joseph
Sky-Lines Aircraft Components, Ltd.
Straight-Lite Reflectors, Ltd.
Wilmot Breeden, Ltd.

COMPRESSORS, INDUSTRIAL
British Brown-Boveri, Ltd.
Dowty Nucleonics, Ltd.
Eagle Aircraft Services, Ltd.
Gloster Technical Developments
Godfrey and Partners, Ltd., Sir George
Headland Engineering Developments, Ltd.
Hymatic Engineering Co., Ltd., The
Lacy Hulbert and Co., Ltd.
Newton and Co., H. T.
Rover Gas Turbines, Ltd.
Siebe, Gorman and Co., Ltd.
Stewart Aeronautical Supply Co.
Wellworthy, Ltd.
Williams and James (Engineers), Ltd.



Solartron analogue computer.

COMPUTERS, ANALOGUE, AND EQUIPMENT
(see also Data-processing equipment)
Air Trainers Link, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd.
Fairey Aviation Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Honeywell Controls, Ltd.
Ketay, Ltd.
Miles, Ltd., F. G.
Redifon, Ltd.
Royston Instruments, Ltd.
Saunders-Roe, Ltd.
Scottish Distributors, Ltd.
Short Brothers and Harland, Ltd.
Solartron Electronic Group
Southern Instruments, Ltd.
Standard Telephones and Cables, Ltd.
Thermionic Products, Ltd.

CONNECTORS, ELECTRICAL
Aerocontacts (Sales), Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
Aircraft Marine Products (Great Britain), Ltd.
Amphenol (Great Britain), Ltd.
Belling and Lee, Ltd.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Burndept, Ltd.
C.W.C. Equipment, Ltd.
Coin Insulation, Ltd.
E.R.S. (London), Ltd.
Eagle Aircraft Services, Ltd.
Electrocon, Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Hellermann, Ltd.
M.L. Aviation Co., Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Reliance Cords and Cables, Ltd.
Rist's Wires and Cables, Ltd.
Rotax, Ltd.
Sanders Electronics, Ltd., W. H.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Thorn Electrical Industries, Ltd.
Vosper, Ltd.
Waymouth Gauges and Instruments, Ltd.
Whittemore (Aeradio), Ltd., A. J.
Z and I Aero Services, Ltd.

CONNECTORS, HOSE
Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Airmed, Ltd.
Air Service Training, Ltd.
Avica Equipment, Ltd.
British Ermeto Corporation, Ltd.
Brown Brothers (Aircraft), Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Exactor, Ltd.
Flight Refuelling, Ltd.
High Pressure Components, Ltd.
Hymatic Engineering Co., Ltd., The
Lockheed Hydraulic Brake Co., Ltd.
Maricon, Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Plessey Co., Ltd., The
Power Auxiliaries, Ltd.
Robinson (Gillingham) and Co., Ltd., L.
Rollason Aerocessories, Ltd.
Ross, Ltd., S. Grahame
Sky-Lines Aircraft Components, Ltd.
Spencer Moulton and Co., Ltd., George
Super Oil Seals and Gaskets, Ltd.

CONSULTANT SERVICES
Airwork, Ltd.
Aviation Traders (Engineering), Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Baynes Aircraft Interiors, Ltd.
Bell Precision Engineering Co., Ltd.
Export Packing Service, Ltd.
Fairey Air Surveys, Ltd.
Gloster Technical Developments
Helicopter Sales, Ltd.
International Aeradio, Ltd.
Kent Alloys, Ltd.
Miles, Ltd., F. G.
Newmark, Ltd., Louis
Newton and Co., H. T.
North West Machine Design Co., Ltd.
Power Jets (Research and Development), Ltd.
Rollason Aerocessories, Ltd.
Samlesbury Engineering, Ltd.
Shackleton, Ltd., W. S.
Sky-Lines Aircraft Components, Ltd.
Solartron Electronic Group, Ltd., The
Sutton (Consultants), Ltd., R. W.
Tiltman Langley, Ltd.
Whittemore (Aeradio), Ltd., A. J.
Woodside Die Sinking Co., Ltd.

CONTROLS, ENGINE
Aero Controls, Ltd.
Aerocontacts (Aircraft Distributors), Ltd.
Airline Air Spares, Ltd.
Amal, Ltd.
Aviation Traders (Engineering), Ltd.
Bloctube Controls, Ltd.
Brooklands Aviation, Ltd.
Brown, Ltd., S. G.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Hercules Engineering Co., Ltd., The
Hobson, Ltd., H. M.
Hooper and Co. (Coachbuilders), Ltd.
Iso-Speedic Co., Ltd., The
Lucas (Gas Turbine Equipment), Ltd., Joseph
Negretti and Zambra, Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Teleflex Products, Ltd.
Ultra Electric, Ltd.
Venner, Ltd.

CONTROL EQUIPMENT, REMOTE
Aero Controls, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Bloctube Controls, Ltd.
Brooklands Aviation, Ltd.
Dowty Equipment, Ltd.
Dowty Nucleonics, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Exactor, Ltd.
Fairey Aviation Co., Ltd., The
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Honeywell Controls, Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Ketay, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Pye Telecommunications, Ltd.
Racal Engineering, Ltd.
Standard Telephones and Cables, Ltd.
Stone and Co. (Deptford), Ltd., J.
Teleflex Products, Ltd.
Thorn Electrical Industries, Ltd.
W.S. Electronics (Production), Ltd.
Western Mfg. (Reading), Ltd.

CONTROLS, FLYING
Aerocontacts (Aircraft Distributors), Ltd.
Aero Controls, Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
British Messier, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Elliott Brothers (London), Ltd.
Gloster Aircraft Co., Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Leytonstone Jig and Tool Co., Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Rotax, Ltd.
Sky-Lines Aircraft Components, Ltd.
Teleflex Products, Ltd.
Wilmot Breeden, Ltd.

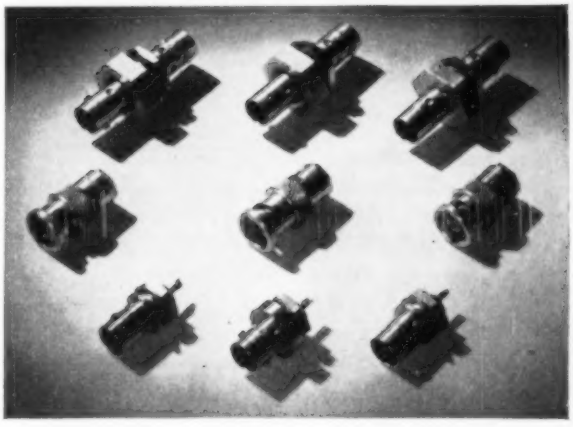
CONTROLS, POWERED
Boulton Paul Aircraft, Ltd.
British Messier, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Fairey Aviation Co., Ltd., The
Gloster Aircraft Co., Ltd.
Hobson, Ltd., H. M.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Rotax, Ltd.
Sky-Lines Aircraft Components, Ltd.
Sperry Gyroscope Co., Ltd.

COOLANTS
Lancefield Aircraft Components, Ltd.
Newton and Co., H. T.

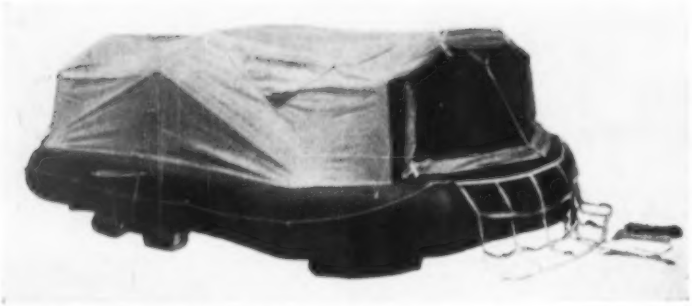
COPPER
Aircraft Materials, Ltd.
Birkett, Billington and Newton, Ltd.
Booth and Co., Ltd., James
British Insulated Callender's Cables, Ltd.
Eagle Aircraft Services, Ltd.
Imperial Chemical Industries, Ltd.
Rapp, Ltd., Leo
Sky-Lines Aircraft Components, Ltd.
Stone and Co. (Charlton), Ltd., J.
Wilson and Sons (London), Ltd., W.

CORROSION INHIBITORS AND EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Albright and Wilson (Mfg.), Ltd.
Brent Chemical Products, Ltd.
Docker Brothers
Eagle Aircraft Services, Ltd.
Kane, Ltd., Douglas
Magnus Chemical Co., Ltd.
Pyrene Co., Ltd., The
Skyhi, Ltd.
Stuart (London), Ltd., Robert
Vaughan and Co., Ltd., Edgar
Walterisation Co., Ltd., The

Three types of Smiths connectors: bulkhead (top row), cable (middle) and panel-mounting. Waymouth Gauges and Instruments, Ltd.



ADDRESSES OF COMPANIES: pages 374-380



"Beaufort" 26-seat airliner raft in neoprene - proofed Terylene, with fluorescent orange canopy, by P. Frankenstein and Sons (Manchester), Ltd.

ANCILLARY INDUSTRY 1958...

COUNTING EQUIPMENT
Burndept, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Ericsson Telephones, Ltd.
Ferranti (Meters), Ltd., Denis
Racal Engineering, Ltd.
Research and Control Instruments, Ltd.
Solartron Electronic Group, Ltd., The
Venner, Ltd.

COUPLINGS, FLEXIBLE (see also Joints, Universal)
Accles and Pollock, Ltd.
Aero Controls, Ltd.
Avery-Hardoll, Ltd.
Avica Equipment, Ltd.
Avimo, Ltd.
Bell's Asbestos and Engineering, Ltd.
Dunlop Rubber Co., Ltd.
Electro-Hydraulics, Ltd.
Fireproof Tanks, Ltd.
Gloster Technical Developments
Hardy Spicer, Ltd.
I.V. Pressure Controllers, Ltd.
King Aircraft Corporation
Laycock Engineering, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Mollart Engineering Co., Ltd., The
Power Auxiliaries, Ltd.
Rellumit (London), Ltd.
Renold Chains, Ltd.
Silentbloc, Ltd.
Spencer Moulton and Co., Ltd., George

COVERS, AIRCRAFT, ETC.
Aerocontacts (Ground Equipment), Ltd.
Aero Maintenance Equipment, Ltd.
Bell's Asbestos and Engineering, Ltd.
Clapham Park Motors, Ltd.
Derwent Manufacturing Co., Ltd.
Eagle Aircraft Services, Ltd.
Elliot Equipment, Ltd.
Export Packing Service, Ltd.
Fireproof Tanks, Ltd.
Fothergill and Harvey (Sales), Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Imperial Chemical Industries, Ltd., (Leathercloth Division)
Lancefield Aircraft Components, Ltd.

DAMPERS, CONTROL
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Girling, Ltd.
Gloster Technical Developments
Honeywell Controls, Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Spencer Moulton and Co., Ltd., George
Westminster Airways Servicing, Ltd.

DAMPERS, GENERAL MOTION
Fairey Air Surveys, Ltd.
Spencer Moulton and Co., Ltd., George

DATA PROCESSING EQUIPMENT
Air Trainers Link, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Decca Radar, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
Honeywell Controls, Ltd.
Ketay, Ltd.
Muirhead and Co., Ltd.
Mullard, Ltd.
Racal Engineering, Ltd.
Redifon, Ltd.
Royston Instruments, Ltd.
Saunders-Roe, Ltd.
Solartron Electronic Group, Ltd., The
Soundrite, Ltd.
Standard Telephones and Cables, Ltd.
Thermionic Products, Ltd.

DECARBONIZING PREPARATIONS AND EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Bennett (Hyde), Ltd.
Brent Chemical Products, Ltd.
Eagle Aircraft Services, Ltd.
Magnus Chemical Co., Ltd.
Newton and Co., H. T.

DEGREASING PREPARATIONS AND EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Albright and Wilson (Mfg.), Ltd.
Bennett (Hyde), Ltd.
Brent Chemical Products, Ltd.
Brown Brothers (Aircraft), Ltd.
Docker Brothers
Eagle Aircraft Services, Ltd.
Irano Products, Ltd.
Laporte Chemicals, Ltd.
Laycock Engineering, Ltd.
Magnus Chemical Co., Ltd.

DE-ICING AND ANTI-ICING EQUIPMENT AND FLUIDS, ETC.
Aerocontacts (Ground Equipment), Ltd.
Avica Equipment, Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Bell's Asbestos and Engineering, Ltd.
Delaney Gallay, Ltd.
Dragonair, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Godden (Mouldings), Ltd., M. H.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
Heckford, Ltd., Arthur E.
Isopad, Ltd.
Kenilworth Manufacturing Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph.
Manchester Oil Refinery (Sales), Ltd.
Metachemical Processes, Ltd.
Miles, Ltd., F. G.
Napier and Son, Ltd., D.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Plessey Co., Ltd., The
Rollason Aerocessories, Ltd.
Rotax, Ltd.
Saunders Valve Co., Ltd.
Serck Radiators, Ltd.
Stewart Aeronautical Supply Co., Ltd.
T.K.S. (Aircraft De-Icing), Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.
Teddington Aircraft Controls, Ltd.
Wilmot Breeden, Ltd.

DESIGN AND EXPERIMENTAL WORK (see also Drawing Office Services)
Abbey Panel and Sheet Metal Co., Ltd., The
Airmed, Ltd.
Aero Controls, Ltd.
Aircraft Materials, Ltd.
Air Service Training, Ltd.
Airwork, Ltd.
Andec, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineering), Ltd.
Avimo, Ltd.
B. R. D. Co., Ltd.
Baynes Aircraft Interiors, Ltd.
Bell Precision Engineering Co., Ltd.
Boulton Paul Aircraft, Ltd.
Bradley, Ltd., G. and E.
British Aviation Services (Engineering), Ltd.
Brooklands Aviation, Ltd.
Burgess and Co., Ltd., G. N.
Burndept, Ltd.
Burnley Aircraft Products, Ltd.
C.J.C. Developments (Portsmouth), Ltd.
Centrax, Ltd.
Cornercroft, Ltd.
Cossor Radar and Electronics, Ltd.
Cross Manufacturing Co. (1938), Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd.
Export Packing Service, Ltd.
Fairey Air Surveys, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Flight Refuelling, Ltd.
Frankenstein and Sons (Manchester), Ltd., P.
Gloster Technical Developments
G. Q. Parachute Co., Ltd.
Graseby Instruments, Ltd.
Hairlok Co., Ltd., The
Handley Page, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Heston Aircraft and Associated Engineers, Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Hymatic Engineering Co., Ltd., The
Irving Air Chute of Great Britain, Ltd.
Irwin and Partners, Ltd., E. G.
Jig Design and Engineering Co.
Ketay, Ltd.
King Aircraft Corporation
Kingston Instrument Co., Ltd.
London Production Tools, Ltd.
M. L. Aviation Co., Ltd.
Mechanism, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Miles Structural Plastics, Ltd.
Mollart Engineering Co., Ltd., The
Morfax, Ltd.
Newmark, Ltd., Louis
North West Machine Design Co., Ltd.
Page Engineering Co.
Plessey Co., Ltd., The
Portsmouth Aviation, Ltd.
Pullin and Co., Ltd., R. B.
Reynolds (Packaging), Ltd.
Rivers, Ltd., A. E.
Rollason Aerocessories, Ltd.
Samlesbury Engineering, Ltd.
Sanders (Electronics), Ltd., W. H.
Saunders-Roe, Ltd.
Scotney, Ltd., Tom M.
Short and Mason, Ltd.
Siebe, Gorman and Co., Ltd.
Soundrite, Ltd.
Specto, Ltd.
Thermo-Plastics, Ltd.
Tiltman Langley, Ltd.
Vosper, Ltd.
Western Mfg. (Reading), Ltd.
Westminster Airways Servicing, Ltd.
Woodside Die Sinking Co., Ltd.

DIALS, INSTRUMENT
Astralux, Ltd.
Coin Insulation, Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Kelvin and Hughes (Aviation), Ltd.
Miles, Ltd., F. G.
Muirhead and Co., Ltd.
Newton and Co., H. T.
Pandect Instrument Laboratories, Ltd.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Turner Electrical Instruments, Ltd., Ernest

DIAMONDS AND DIAMOND TOOLS
Van Moppes and Sons (Diamond Tools), Ltd., L. M.

DIAPHRAGMS
Dunlop Rubber Co., Ltd.
Fireproof Tanks, Ltd.
Hall and Hall, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Kelvin and Hughes, Ltd.
Long and Hambly, Ltd.
Mechanism, Ltd.
Munro, Ltd., R. W.
Negretti and Zambra, Ltd.
Newton and Co., H. T.
Precision Rubbers, Ltd.
Samlesbury Engineering, Ltd.
Short and Mason, Ltd.
Spencer Moulton and Co., Ltd., George
Trist and Co., Ltd., Ronald

DINGHIES
Aerocontacts (Sales), Ltd.
Eagle Aircraft Services, Ltd.
Elliot Equipment, Ltd.
Frankenstein and Sons (Manchester), Ltd., P.
Jablo Plastics Industries, Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
R.F.D. Co., Ltd.

DOCKS, AIRCRAFT MAINTENANCE
Aerocontacts (Ground Equipment), Ltd.
Aviation Traders (Engineering), Ltd.
Heston Aircraft and Associated Engineers, Ltd.
Mercury Airfield Equipment, Ltd.
Morfax, Ltd.
Ross, Ltd., S. Grahame

Nosonic Mk 5 ear defender, with pneumatic seal (Anticoustic Co.).

DOORS FOLDING, SLIDING, ETC. (see also Shutters)
Brockhouse and Co., Ltd., J.
Esavian, Ltd.
Morfax, Ltd.
Walker (A. D.), Ltd., James

DOPES—see Finishes

DRAWING OFFICE EQUIPMENT
Aeronautical Trades and Manufacturing Co., Ltd.
Mavitta Drafting Machines, Ltd.
Scottish Distributors, Ltd.

DRAWING OFFICE SERVICES (see also Design and Experimental Work)
Aero Controls, Ltd.
Air Service Training, Ltd.
Airwork, Ltd.
Aviation Traders (Engineering), Ltd.
Baynes Aircraft Interiors, Ltd.
Bell Precision Engineering Co., Ltd.
British Aviation Services (Engineering), Ltd.
Brooklands Aviation, Ltd.

FOR ADDRESSES OF COMPANIES PLEASE TURN TO PAGES 374-380

Burndept, Ltd.
Centrax, Ltd.
Eagle Aircraft Services, Ltd.
Ferranti (Meters), Ltd., Denis
G. Q. Parachute Co., Ltd.
Heston Aircraft and Associated Engineers, Ltd.
Irwin and Partners, Ltd., E. G.
Jig Design and Engineering Co.
King Aircraft Corporation
Leytonstone Jig and Tool Co., Ltd.
Mechanism, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Newmark, Ltd., Louis
North West Machine Design Co., Ltd.
Rollason Aerocessories, Ltd.
Samlesbury Engineering, Ltd.
Scotney, Ltd., Tom M.
Skyways, Ltd.
Tiltman Langley, Ltd.
Woodside Die Sinking Co., Ltd.

EAR DEFENDERS

Airmed, Ltd.
Anticoustic Co., The
Ferranti (Meters), Ltd., Denis
Long and Hambly, Ltd.
Mallock-Armstrong Co., The
Siebe, Gorman and Co., Ltd.
Sutton (Consultants), Ltd., R. W.

EDUCATION, TECHNICAL
(other than apprenticeships)

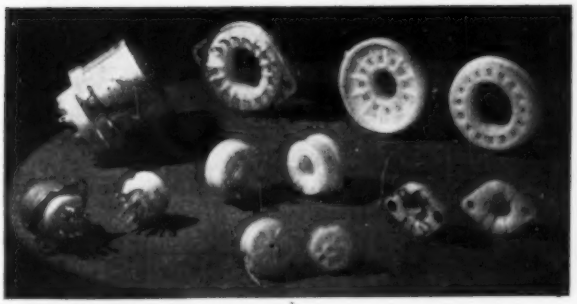
Air Service Training, Ltd.
London School of Air Navigation, Ltd., The
Marconi's Wireless Telegraph Co., Ltd.
Sanders (Electronics), Ltd., W. H.

ELECTRICAL EQUIPMENT GENERAL
(see also under Components)

Aerocontacts (Sales), Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
Airline Air Spares, Ltd.
Andec, Ltd.
Avimo, Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Bell Precision Engineering Co., Ltd.
Belling and Lee, Ltd.
British Thomson-Houston Co., Ltd., The
Burndept, Ltd.
Dobbie McInnes, Ltd.
E.R.S. (London), Ltd.
Electro-Hydraulics, Ltd.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Gloster Technical Developments, Ltd.
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Isopad, Ltd.
Ketay, Ltd.
Lucas, Ltd, Joseph
M. L. Aviation Co., Ltd.
Miles, Ltd., F. G.
Newmark, Ltd., Louis
Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Phillips and White, Ltd.
Plessey Co., Ltd., The
Racal Engineering, Ltd.
Rotax, Ltd.
Saunders-Roe, Ltd.
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Sky-Lines Aircraft Components, Ltd.
Soundrite, Ltd.
Specto, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.
Tiltman Langley, Ltd.
Vernons Industries, Ltd.
Vosper, Ltd.
Western Mfg. (Reading), Ltd.
Westinghouse Brake and Signal Co., Ltd.
Westminster Airways Servicing, Ltd.
Whittemore (Aeradio), Ltd., A. J.
Wynn and Co. (Aircraft), Ltd., E. D.

ELECTRONIC EQUIPMENT GENERAL
(see also under Components)

Aerocontacts (Sales), Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
Andec, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Avimo, Ltd.
Bell Precision Engineering Co., Ltd.
Belling and Lee, Ltd.
Blake (Brentwood), Ltd., Geo. A.
Boulton Paul Aircraft, Ltd.
Bradley, Ltd., G. and E.
British Thomson-Houston Co., Ltd.
Burndept, Ltd.
Cossor Instruments, Ltd.
Cossor Radar and Electronics, Ltd.
Dawe Instruments, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
E.R.S. (London), Ltd.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Flight Refuelling, Ltd.
General Electric Co., Ltd., The
Gloster Technical Developments
International Aeradio, Ltd.
Kent, Ltd., George
Ketay, Ltd.
M. L. Aviation Co., Ltd.
Marconi's Wireless Telegraph Co., Ltd.
McMichael Radio, Ltd.
Measuring Instruments (Pullin), Ltd.
Microcell, Ltd.
Miles, Ltd., F. G.
Mining and Chemical Products, Ltd.
Muirhead and Co., Ltd.
Mullard, Ltd.
Murphy Radio, Ltd.
Newmark, Ltd., Louis.
Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Pullin and Co., Ltd., R. B.
Pye Telecommunications, Ltd.
Racal Engineering, Ltd.
Redifon, Ltd.
Royston Instruments, Ltd.
Sanders (Electronics), Ltd., W. H.
Saunders-Roe, Ltd.



Typical Edison Swan electrical details embodying fluro-carbons.

Sciaky Electric Welding Machines, Ltd.
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Solartron Electronic Group, Ltd., The
Soundrite, Ltd.
Southern Instruments, Ltd.
Specto, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.
Thermionic Products Ltd.
Ultra Electric, Ltd.
W.S. Electronics (Production), Ltd.
Wayne Kerr Laboratories, Ltd., The
Western Mfg. (Reading), Ltd.
Westinghouse Brake and Signal Co., Ltd.
Westminster Airways Servicing, Ltd.
Whittemore (Aeradio), Ltd., A. J.

EMERGENCY EQUIPMENT—
see Life-saving equipment

ENGINE COMPONENTS, GENERAL
(piston engines)

Abbey Panel and Sheet Metal Co., Ltd., The
Aerocontacts (Aircraft Distributors), Ltd.
Aerocontacts (Sales), Ltd.
Aero Controls, Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
Avica Equipment, Ltd.
B.R.D. Co., Ltd.
Bell Precision Engineering Co., Ltd.
Birkett, Billington and Newton, Ltd.
Bretts Precision Engineering Co., Ltd.
Bristol Aircraft, Ltd.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Centrax, Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Dobbie McInnes, Ltd.
Dunlop Rubber Co., Ltd. (Aviation Division)
Eagle Aircraft Services, Ltd.
Goulder and Sons, Ltd., J.
Hercules Engineering Co., Ltd., The
Hooper and Co. (Coachbuilders), Ltd.
Hymatic Engineering Co., Ltd., The
Kelston Engineering Co., Ltd.
King Aircraft Corporation
Leytonstone Jig and Tool Co., Ltd.
Newton and Co., H. T.
Phillips and White, Ltd.
Pipework and Engineering (Bristol), Ltd.
Plessey Co., Ltd., The
Samlesbury Engineering, Ltd.
Sky-Lines Aircraft Components, Ltd.
Spa Guilds, Ltd.
Trist and Co., Ltd., Ronald
Weyburn Engineering Co., Ltd.
Woodside Die Sinking Co., Ltd.
Yorkshire Engineering Supplies, Ltd.

ENGINE COMPONENTS, GENERAL
(gas turbines)

Abbey Panel and Sheet Metal Co., Ltd., The
Avica Equipment, Ltd.
B.R.D. Co., Ltd.
Bell Precision Engineering Co., Ltd.
Bretts Precision Engineering Co., Ltd.
Bristol Aircraft, Ltd.
British Thomson-Houston Co., Ltd.
Brown Brothers (Aircraft), Ltd.
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Clifford Products, Ltd.
Dart Aircraft, Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Dobbie McInnes, Ltd.
Dunlop Rubber Co., Ltd. (Aviation Division)
Eagle Aircraft Services, Ltd.
Elliott Brothers (London), Ltd.
Goulder and Sons, Ltd., J.
Hadfields, Ltd.
Hercules Engineering Co., Ltd., The
Hooper and Co. (Coachbuilders), Ltd.
Hymatic Engineering Co., Ltd., The
Jessop and Sons, Ltd., William
Kelston Engineering Co., Ltd.
King Aircraft Corporation
Leytonstone Jig and Tool Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Morfax, Ltd.
Newton and Co., H. T.
Pipework and Engineering (Bristol), Ltd.
Plessey Co., Ltd., The
Rotol, Ltd.
Rover Gas Turbines, Ltd.
Samlesbury Engineering, Ltd.
Sky-Lines Aircraft Components, Ltd.
Spa Guilds, Ltd.
Trist and Co., Ltd., Ronald
Wilmot Breeden, Ltd.
Woodside Die Sinking Co., Ltd.
Yorkshire Engineering Supplies, Ltd.

ENGINE STARTERS AND STARTING EQUIPMENT
(see also Ground Power Units)

Aerocontacts (Ground Equipment), Ltd.
Aero Maintenance Equipment, Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Armstrong Siddeley Motors, Ltd.
Avica Equipment, Ltd.
Blackburn and General Aircraft, Ltd.
British Thomson-Houston Co., Ltd., The
Clapham Park Motors, Ltd.
Clifford Products, Ltd.
English Electric Co., Ltd.
Folland Aircraft, Ltd.
Houchin, Ltd.
Kigass, Ltd.
Murex Welding Processes, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Rover Gas Turbines, Ltd.
Sky-Lines Aircraft Components, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Venner Accumulators, Ltd.
Vernons Industries, Ltd.
Walter, A. J.
Westinghouse Brake and Signal Co., Ltd.
Williams and James (Engineers), Ltd.

EXPERIMENTAL WORK
—see Design

EXTRUSIONS, LIGHT ALLOY

Booth and Co., Ltd., James
Eagle Aircraft Services, Ltd.

Continued overleaf

Maintenance dock (in B.O.A.C. Britannia hangar at London Airport) supplied by Mercury Airfield Equipment. The doors in the background, saving height by surrounding the aircraft tails, are by Morfax, Ltd.

ANCILLARY INDUSTRY 1958...

French and Sons, Ltd., Thomas
High Duty Alloys, Ltd.
Imperial Chemical Industries, Ltd.
Northern Aluminium Co., Ltd.
Rapp, Ltd., Leo
Reynolds T.I. Aluminium, Ltd.
Rollet and Co., Ltd., H.
Rumbold and Co., Ltd., L. A.
Wilson and Sons (London), Ltd., W.

EXTRUSIONS, STEEL

Eagle Aircraft Services, Ltd.
Low Moor Alloy Steelworks, Ltd.
Low Moor Fine Steels, Ltd.
Rapp, Ltd., Leo
Rollet and Co., Ltd. H.

FABRICATIONS, SHEET METAL

Abbey Panel and Sheet Metal Co., Ltd., The
Aero Controls, Ltd.
Aircraft Materials, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Astralux, Ltd.
Attewell and Sons, Ltd., B.
Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
Bell Precision Engineering Co., Ltd.
Bramah and Co., Ltd., J. R.
British Refrasil Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Clifford Products, Ltd.
Cornercroft, Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Dragonair, Ltd.
Eagle Aircraft Services, Ltd.
Eccles (Birmingham), Ltd.
Fairey Aviation Co., Ltd. ,The
Fawcett, Preston and Co., Ltd.
Gloster Aircraft Co., Ltd.
Gloster Engineering (Cheltenham), Ltd.
Harvey and Co. (London), Ltd., G. A.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Jablo Plastics Industries, Ltd.
Lancefield Aircraft Components, Ltd.
London Production Tools, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Marston Excelsior, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Morfax, Ltd.
Parnall and Co., Ltd., George
Pegasus Engineering, Ltd.
Potter, Ltd., Walter
Redwing, Ltd.
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.
Sankey and Sons, Ltd., Joseph
Saunders-Roe, Ltd.
Sky-Lines Aircraft Components, Ltd.
Skyways, Ltd.
Straight-Lite Reflectors, Ltd.
Tiltman Langley, Ltd.
Vernons Industries, Ltd.
Vosper, Ltd.
Wellwinch Engineering, Ltd.
Western Mfg. (Reading), Ltd.
Wilmot Breeden, Ltd.
Young, Ltd., James

FABRICATIONS, TUBULAR

Abbey Panel and Sheet Metal Co., Ltd., The
Aero Controls, Ltd.
Astralux, Ltd.
Aviation Traders (Engineering), Ltd.
Bell Precision Engineering Co., Ltd.
Brockhouse and Co., Ltd., J.
Brown Brothers (Aircraft), Ltd.
Burgess and Co., Ltd., G. N.
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Cornercroft, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Lancefield Aircraft Components, Ltd.
London Production Tools, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Morfax, Ltd.
Pipework and Engineering (Bristol), Ltd.
Potter, Ltd., Walter
Reynolds Tube Co., Ltd.
Ross, Ltd., S. Grahame
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.
Sky-Lines Aircraft Components, Ltd.
Wellwinch Engineering, Ltd.
Western Manufacturing (Reading), Ltd.
Wilmot Breeden, Ltd.

FABRIC, AIRFRAME

Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Brooklands Aviation, Ltd.
Brown Brothers (Aircraft), Ltd.
Eagle Aircraft Services, Ltd.
Fothergill and Harvey (Sales), Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Vane and Co., A. H.

FABRIC, CABIN FURNISHING

Aerocontacts (Aircraft Distributors), Ltd.
Attewell and Sons, Ltd., B.
Baxter, Woodhouse and Taylor, Ltd.
British Ropes, Ltd.
Cox and Son, Ltd., John
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Fothergill and Harvey (Sales), Ltd.
Imperial Chemical Industries, Ltd. (Leathercloth Division)
Latex Upholstery, Ltd.
Newton and Co., H. T.
R.F.D. Co., Ltd.
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.

FANS
(see also Wind Tunnels and equipment)

Airscrew Co. and Jicwood, Ltd.
General Electric Co., Ltd., The
Godfrey and Partners, Ltd., Sir George
Hordern-Richmond (Sales), Ltd.
Plannair, Ltd.

FASTENERS, INCLUDING COWLING AND SPECIAL PURPOSE

Aerocontacts (Sales), Ltd.
Aero Controls, Ltd.
Aerolex, Ltd.
Aviation Developments, Ltd.
Baynes Aircraft Interiors, Ltd.
Brown Brothers (Aircraft), Ltd.
Carr Fastener Co., Ltd.
Cox and Son, Ltd., John
Dzus Fastener, Europe, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Fireproof Tanks, Ltd.
Guest, Keen and Nettlefolds (Midlands), Ltd.
Hercules Engineering Co., Ltd., The
Kane, Ltd., Douglas
King Aircraft Corporation
M. L. Aviation Co., Ltd.
Oddie, Bradbury and Cull, Ltd.
Rawlplug Co., Ltd., The
Ross, Ltd., S. Grahame
Salter and Co., Ltd., Geo.
Simmonds Aerocessories, Ltd.
Sky-Lines Aircraft Components, Ltd.

FILLERS, FOR TUBE BENDING

Eagle Aircraft Services, Ltd.
Mining and Chemical Products, Ltd.
Terry and Sons, Ltd., Herbert

FILTERS, AIR AND GAS

Aerocontacts (Ground Equipment), Ltd.
Coopers Mechanical Joints, Ltd.
Dunlop Rubber Co., Ltd.,
Eagle Aircraft Services, Ltd.
Fibreglass, Ltd.
Headland Engineering Developments, Ltd.
Hymatic Engineering Co., Ltd., The
I.V. Pressure Controllers, Ltd.
Lacy-Hulbert and Co., Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Rellumit (London), Ltd.
Rotax, Ltd.
Siebe, Gorman and Co., Ltd.
Vokes, Ltd.
Williams and James (Engineers), Ltd.

FILTERS, ELECTRICAL

Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
McMichael Radio, Ltd.
Newton and Co., H. T.
Rotax, Ltd.
Standard Telephones and Cables, Ltd.
Stream-Line Filters, Ltd.
Whittemore (Aeradio), Ltd., A. J.

FILTERS, OTHER FLUID

Aerocontacts (Ground Equipment), Ltd.
Auto-Klean Strainers, Ltd.
British Messier, Ltd.
Coopers Mechanical Joints, Ltd.
Dowty Equipment, Ltd.
Eagle Aircraft Services, Ltd.
Exactor, Ltd.
Fairey Aviation Co., Ltd.
Firth Cleveland Instruments, Ltd.
H.M.L. (Engineering), Ltd.
Henshall and Sons (Addlestone), Ltd., W.
I.V. Pressure Controllers ,Ltd.
King Aircraft Corporation
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Philips Electrical, Ltd.
Rellumit (London), Ltd.
SPE Co., Ltd.
Stream-Line Filters, Ltd.
Tecalemit, Ltd.
Vokes, Ltd.
Zwicky, Ltd.

FILTERS, FUEL AND OIL

Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Airline Air Spares, Ltd.
Amal, Ltd.
Auto-Klean Strainers, Ltd.
Aviation Traders (Engineering), Ltd.
BP Trading, Ltd.
Dunlop Rubber Co., Ltd.
Fairey Aviation Co., Ltd., The
Firth Cleveland Instruments, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Kigass, Ltd.
King Aircraft Corporation
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Philips Electrical, Ltd.
Royston Industries, Ltd.
Saunders Valve Co., Ltd.
Short Brothers and Harland, Ltd.
Simmonds Aerocessories, Ltd.
Simmons and Hawker, Ltd.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Stream-Line Filters, Ltd.
Vokes, Ltd.

FINISHES, AIRCRAFT
(see also Paints)

Aerocontacts (Sales), Ltd.
Albright and Wilson (Mfg.), Ltd.
Cellon, Ltd.
Docker Brothers
Durion, Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Hall and Sons (Bristol and London), Ltd., John
Imperial Chemical Industries, Ltd.
Midland Silicones, Ltd.
Modern Industrial Finishes, Ltd.
Ryland, Ltd., Llewellyn
Sky-Lines Aircraft Components, Ltd.
Titanine, Ltd.

FIRE FIGHTING AND DETECTION EQUIPMENT AIRBORNE

Cathodeon, Ltd.
Graviner Manufacturing Co., Ltd.
Kidde Co., Ltd., The Walter
Pyrene Co., Ltd., The
Stewart Aeronautical Supply Co., Ltd.
Thermal Control Co., Ltd.

FIRE FIGHTING EQUIPMENT GROUND

Aerocontacts (Ground Equipment), Ltd.
Bell's Asbestos and Engineering, Ltd.
Flint, Ltd., Howard
Frankenstein and Sons (Manchester), Ltd., P.
General Fire Appliance Co., Ltd.
Kidde Co., Ltd., The Walter
Pyrene Co., Ltd., The
Rover Gas Turbines, Ltd.
Siebe, Gorman and Co., Ltd.
Siemens Edison Swan, Ltd.
Thornycroft and Co., Ltd., John I.

FLAME TRAPS

Amal, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Vokes, Ltd.

FLAW-DETECTION EQUIPMENT AND MATERIALS

Aerocontacts (Ground Equipment), Ltd.
Brent Chemical Products, Ltd.
Kelvin and Hughes, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Manchester Oil Refinery (Sales), Ltd.
Research and Control Instruments, Ltd.
Sperry Gyroscope Co., Ltd.

FLOTATION GEAR

Fireproof Tanks, Ltd.
Jablo Plastics Industries, Ltd.
Kidde Co., Ltd., The Walter
Newton and Co., H. T.
R.F.D. Co., Ltd.
Ross, Ltd., S. Grahame

FLUID, HYDRAULIC

Eagle Aircraft Services, Ltd.
Esso Petroleum Co., Ltd.
Kenilworth Manufacturing Co., Ltd., The
Lockheed Hydraulic Brake Co., Ltd.
Manchester Oil Refinery (Sales), Ltd.
Midland Silicones, Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.

FLUIDS, ETC., INDUSTRIAL
(other than under specific headings)

Aerocontacts (Ground Equipment), Ltd.
Eagle Aircraft Services, Ltd.
Kane, Ltd., Douglas
Midland Silicones, Ltd.

FORGINGS, DROP

Brockhouse and Co., Ltd., J.
English Steel Forge and Engineering Corporation, Ltd.
Firth-Derihon Stampings, Ltd., The
Garringtons, Ltd.
Hughes-Johnson Stampings, Ltd., The
Laycock Engineering, Ltd.
Northern Aluminium Co., Ltd.
Omes, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Stone and Co. (Charlton), Ltd., J.

FORGINGS IN HEAT RESISTING MATERIALS

Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Jessop and Sons, Ltd., William
Kayser, Elison and Co., Ltd.
Low Moor Alloy Steelworks, Ltd.
Omes, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Wiggin and Co., Ltd., Henry

FORGINGS, LIGHT ALLOY

Booth and Co., Ltd., James
High Duty Alloys, Ltd.
Hughes-Johnson Stampings, Ltd., The
Northern Aluminium Co., Ltd.
Omes, Ltd.
Reynolds Tube Co., Ltd.
Sky-Lines Aircraft Components, Ltd.
Southern Forge, Ltd.

FORGINGS, STEEL

Brockhouse and Co., Ltd., J.
Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
English Steel Forge and Engineering Corporation, Ltd.
Firth-Vickers Stainless Steels, Ltd.
Firth and John Brown, Ltd., Thos.
Hughes-Johnson Stampings, Ltd., The
Kayser, Ellison and Co., Ltd.
Laycock Engineering, Ltd.
Low Moor Alloy Steelworks, Ltd.
Macready's Metal Co., Ltd.
Omes, Ltd.
Reynolds Tube Co., Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Steel, Peech and Tozer

FORGINGS, OTHER THAN ABOVE

Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Jessop and Sons, Ltd., William
Omes, Ltd.
Stone and Co. (Charlton), Ltd., J.
Tubes, Ltd.
Vosper, Ltd.

ADDRESSES OF COMPANIES: pages 374-380

Looking for the best method of aircraft hygiene?

This entirely self-contained unit is the answer

From the passengers' point of view, there is nothing makeshift or uninviting about its appearance, it flushes normally and is completely odourless.

From your point of view, it is entirely self-contained, with no extra tanks on the one hand and no problems of fuselage corrosion on the other. There is also no necessity for ground equipment. You simply lift it out in its entirety for cleaning and replace it with a fresh one. Total time taken—about 3 minutes!

Check these extra advantages

- ★ Weighs only 26 lb (12 kg) approx.
- ★ Stainless steel throughout
- ★ No need to stress fuselage bulkheads
- ★ Interchangeable with existing units
- ★ Low cost because of large scale production
- ★ Designed in conjunction with B.E.A. and standard on their Viscount Majors. Also used on the Fokker Friendship.

Full details are readily available. Write or 'phone now—

DELANEY GALLAY LTD

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Telephone:
GLAdstone 2201.

ANCILLARY INDUSTRY 1958...

French and Sons, Ltd., Thomas
High Duty Alloys, Ltd.
Imperial Chemical Industries, Ltd.
Northern Aluminium Co., Ltd.
Rapp, Ltd., Leo
Reynolds T.I. Aluminium, Ltd.
Rollet and Co., Ltd., H.
Rumbold and Co., Ltd., L. A.
Wilson and Sons (London), Ltd., W.

EXTRUSIONS, STEEL

Eagle Aircraft Services, Ltd.
Low Moor Alloy Steelworks, Ltd.
Low Moor Fine Steels, Ltd.
Rapp, Ltd., Leo
Rollet and Co., Ltd. H.

FABRICATIONS, SHEET METAL

Abbey Panel and Sheet Metal Co., Ltd., The
Aero Controls, Ltd.
Aircraft Materials, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Astralux, Ltd.
Attewell and Sons, Ltd., B.
Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
Bell Precision Engineering Co., Ltd.
Bramah and Co., Ltd., J. R.
British Refrasil Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Clifford Products, Ltd.
Cornercroft, Ltd.
de Havilland Engine Co., Ltd., The
Delaney Gallay, Ltd.
Dragonair, Ltd.
Eagle Aircraft Services, Ltd.
Eccles (Birmingham), Ltd.
Fairey Aviation Co., Ltd. ,The
Fawcett, Preston and Co., Ltd.
Gloster Aircraft Co., Ltd.
Gloster Engineering (Cheltenham), Ltd.
Harvey and Co. (London), Ltd., G. A.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Jablo Plastics Industries, Ltd.
Lancefield Aircraft Components, Ltd.
London Production Tools, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Marston Excelsior, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Morfax, Ltd.
Parnall and Co., Ltd., George
Pegasus Engineering, Ltd.
Potter, Ltd., Walter
Redwing, Ltd.
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.
Sankey and Sons, Ltd., Joseph
Saunders-Roe, Ltd.
Sky-Lines Aircraft Components, Ltd.
Skyways, Ltd.
Straight-Lite Reflectors, Ltd.
Tiltman Langley, Ltd.
Vernons Industries, Ltd.
Vosper, Ltd.
Wellwinch Engineering, Ltd.
Western Mfg. (Reading), Ltd.
Wilmot Breeden, Ltd.
Young, Ltd., James

FABRICATIONS, TUBULAR

Abbey Panel and Sheet Metal Co., Ltd., The
Aero Controls, Ltd.
Astralux, Ltd.
Aviation Traders (Engineering), Ltd.
Bell Precision Engineering Co., Ltd.
Brockhouse and Co., Ltd., J.
Brown Brothers (Aircraft), Ltd.
Burgess and Co., Ltd., G. N.
Burnley Aircraft Products, Ltd.
Centrax, Ltd.
Cornercroft, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Lancefield Aircraft Components, Ltd.
London Production Tools, Ltd.
Mercury Airfield Equipment, Ltd.
Miles, Ltd., F. G.
Morfax, Ltd.
Pipework and Engineering (Bristol), Ltd.
Potter, Ltd., Walter
Reynolds Tube Co., Ltd.
Ross, Ltd., S. Grahame
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.
Sky-Lines Aircraft Components, Ltd.
Wellwinch Engineering, Ltd.
Western Manufacturing (Reading), Ltd.
Wilmot Breeden, Ltd.

FABRIC, AIRFRAME

Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Brooklands Aviation, Ltd.
Brown Brothers (Aircraft), Ltd.
Eagle Aircraft Services, Ltd.
Fothergill and Harvey (Sales), Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Vane and Co., A. H.

FABRIC, CABIN FURNISHING

Aerocontacts (Aircraft Distributors), Ltd.
Attewell and Sons, Ltd., B.
Baxter, Woodhouse and Taylor, Ltd.
British Ropes, Ltd.
Cox and Son, Ltd., John
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Fothergill and Harvey (Sales), Ltd.
Imperial Chemical Industries, Ltd. (Leathercloth Division)
Latex Upholstery, Ltd.
Newton and Co., H. T.
R.F.D. Co., Ltd.
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.

FANS
(see also Wind Tunnels and equipment)

Airscrew Co. and Jicwood, Ltd.
General Electric Co., Ltd., The
Godfrey and Partners, Ltd., Sir George
Hordern-Richmond (Sales), Ltd.
Plannair, Ltd.

FASTENERS, INCLUDING COWLING AND SPECIAL PURPOSE

Aerocontacts (Sales), Ltd.
Aero Controls, Ltd.
Aerolex, Ltd.
Aviation Developments, Ltd.
Baynes Aircraft Interiors, Ltd.
Brown Brothers (Aircraft), Ltd.
Carr Fastener Co., Ltd.
Cox and Son, Ltd., John
Dzus Fastener, Europe, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Fireproof Tanks, Ltd.
Guest, Keen and Nettlefolds (Midlands), Ltd.
Hercules Engineering Co., Ltd., The
Kane, Ltd., Douglas
King Aircraft Corporation
M. L. Aviation Co., Ltd.
Oddie, Bradbury and Cull, Ltd.
Rawlplug Co., Ltd., The
Ross, Ltd., S. Grahame
Salter and Co., Ltd., Geo.
Simmonds Aerocessories, Ltd.
Sky-Lines Aircraft Components, Ltd.

FILLERS, FOR TUBE BENDING

Eagle Aircraft Services, Ltd.
Mining and Chemical Products, Ltd.
Terry and Sons, Ltd., Herbert

FILTERS, AIR AND GAS

Aerocontacts (Ground Equipment), Ltd.
Coopers Mechanical Joints, Ltd.
Dunlop Rubber Co., Ltd.,
Eagle Aircraft Services, Ltd.
Fibreglass, Ltd.
Headland Engineering Developments, Ltd.
Hymatic Engineering Co., Ltd., The
I.V. Pressure Controllers, Ltd.
Lacy-Hulbert and Co., Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Rellumit (London), Ltd.
Rotax, Ltd.
Siebe, Gorman and Co., Ltd.
Vokes, Ltd.
Williams and James (Engineers), Ltd.

FILTERS, ELECTRICAL

Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
McMichael Radio, Ltd.
Newton and Co., H. T.
Rotax, Ltd.
Standard Telephones and Cables, Ltd.
Stream-Line Filters, Ltd.
Whittemore (Aeradio), Ltd., A. J.

FILTERS, OTHER FLUID

Aerocontacts (Ground Equipment), Ltd.
Auto-Klean Strainers, Ltd.
British Messier, Ltd.
Coopers Mechanical Joints, Ltd.
Dowty Equipment, Ltd.
Eagle Aircraft Services, Ltd.
Exactor, Ltd.
Fairey Aviation Co., Ltd.
Firth Cleveland Instruments, Ltd.
H.M.L. (Engineering), Ltd.
Henshall and Sons (Addlestone), Ltd., W.
I.V. Pressure Controllers ,Ltd.
King Aircraft Corporation
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Philips Electrical, Ltd.
Rellumit (London), Ltd.
SPE Co., Ltd.
Stream-Line Filters, Ltd.
Tecalemit, Ltd.
Vokes, Ltd.
Zwicky, Ltd.

FILTERS, FUEL AND OIL

Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Airline Air Spares, Ltd.
Amal, Ltd.
Auto-Klean Strainers, Ltd.
Aviation Traders (Engineering), Ltd.
BP Trading, Ltd.
Dunlop Rubber Co., Ltd.
Fairey Aviation Co., Ltd., The
Firth Cleveland Instruments, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Kigass, Ltd.
King Aircraft Corporation
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Philips Electrical, Ltd.
Royston Industries, Ltd.
Saunders Valve Co., Ltd.
Short Brothers and Harland, Ltd.
Simmonds Aerocessories, Ltd.
Simmons and Hawker, Ltd.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Stream-Line Filters, Ltd.
Vokes, Ltd.

FINISHES, AIRCRAFT
(see also Paints)

Aerocontacts (Sales), Ltd.
Albright and Wilson (Mfg.), Ltd.
Cellon, Ltd.
Docker Brothers
Durion, Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Hall and Sons (Bristol and London), Ltd., John
Imperial Chemical Industries, Ltd.
Midland Silicones, Ltd.
Modern Industrial Finishes, Ltd.
Ryland, Ltd., Llewellyn
Sky-Lines Aircraft Components, Ltd.
Titanine, Ltd.

FIRE FIGHTING AND DETECTION EQUIPMENT AIRBORNE

Cathodeon, Ltd.
Graviner Manufacturing Co., Ltd.
Kidde Co., Ltd., The Walter
Pyrene Co., Ltd., The
Stewart Aeronautical Supply Co., Ltd.
Thermal Control Co., Ltd.

FIRE FIGHTING EQUIPMENT GROUND

Aerocontacts (Ground Equipment), Ltd.
Bell's Asbestos and Engineering, Ltd.
Flint, Ltd., Howard
Frankenstein and Sons (Manchester), Ltd., P.
General Fire Appliance Co., Ltd.
Kidde Co., Ltd., The Walter
Pyrene Co., Ltd., The
Rover Gas Turbines, Ltd.
Siebe, Gorman and Co., Ltd.
Siemens Edison Swan, Ltd.
Thornycroft and Co., Ltd., John I.

FLAME TRAPS

Amal, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Vokes, Ltd.

FLAW-DETECTION EQUIPMENT AND MATERIALS

Aerocontacts (Ground Equipment), Ltd.
Brent Chemical Products, Ltd.
Kelvin and Hughes, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Manchester Oil Refinery (Sales), Ltd.
Research and Control Instruments, Ltd.
Sperry Gyroscope Co., Ltd.

FLOTATION GEAR

Fireproof Tanks, Ltd.
Jablo Plastics Industries, Ltd.
Kidde Co., Ltd., The Walter
Newton and Co., H. T.
R.F.D. Co., Ltd.
Ross, Ltd., S. Grahame

FLUID, HYDRAULIC

Eagle Aircraft Services, Ltd.
Esso Petroleum Co., Ltd.
Kenilworth Manufacturing Co., Ltd., The
Lockheed Hydraulic Brake Co., Ltd.
Manchester Oil Refinery (Sales), Ltd.
Midland Silicones, Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.

FLUIDS, ETC., INDUSTRIAL
(other than under specific headings)

Aerocontacts (Ground Equipment), Ltd.
Eagle Aircraft Services, Ltd.
Kane, Ltd., Douglas
Midland Silicones, Ltd.

FORGINGS, DROP

Brockhouse and Co., Ltd., J.
English Steel Forge and Engineering Corporation, Ltd.
Firth-Derihon Stampings, Ltd., The
Garringtons, Ltd.
Hughes-Johnson Stampings, Ltd., The
Laycock Engineering, Ltd.
Northern Aluminium Co., Ltd.
Omes, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Stone and Co. (Charlton), Ltd., J.

FORGINGS IN HEAT RESISTING MATERIALS

Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Jessop and Sons, Ltd., William
Kayser, Elison and Co., Ltd.
Low Moor Alloy Steelworks, Ltd.
Omes, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Wiggin and Co., Ltd., Henry

FORGINGS, LIGHT ALLOY

Booth and Co., Ltd., James
High Duty Alloys, Ltd.
Hughes-Johnson Stampings, Ltd., The
Northern Aluminium Co., Ltd.
Omes, Ltd.
Reynolds Tube Co., Ltd.
Sky-Lines Aircraft Components, Ltd.
Southern Forge, Ltd.

FORGINGS, STEEL

Brockhouse and Co., Ltd., J.
Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
English Steel Forge and Engineering Corporation, Ltd.
Firth-Vickers Stainless Steels, Ltd.
Firth and John Brown, Ltd., Thos.
Hughes-Johnson Stampings, Ltd., The
Kayser, Ellison and Co., Ltd.
Laycock Engineering, Ltd.
Low Moor Alloy Steelworks, Ltd.
Macready's Metal Co., Ltd.
Omes, Ltd.
Reynolds Tube Co., Ltd.
Sky-Lines Aircraft Components, Ltd.
Smith's Stamping Works (Coventry), Ltd.
Steel, Peech and Tozer

FORGINGS, OTHER THAN ABOVE

Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Jessop and Sons, Ltd., William
Omes, Ltd.
Stone and Co. (Charlton), Ltd., J.
Tubes, Ltd.
Vosper, Ltd.

ADDRESSES OF COMPANIES: pages 374-380

Looking for the best method of aircraft hygiene?

This entirely self-contained unit is the answer

From the passengers' point of view, there is nothing makeshift or uninviting about its appearance, it flushes normally and is completely odourless.

From your point of view, it is entirely self-contained, with no extra tanks on the one hand and no problems of fuselage corrosion on the other. There is also no necessity for ground equipment. You simply lift it out in its entirety for cleaning and replace it with a fresh one. Total time taken—about 3 minutes!

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- ★ Weighs only 26 lb (12 kg) approx.
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- ★ Interchangeable with existing units
- ★ Low cost because of large scale production
- ★ Designed in conjunction with B.E.A. and standard on their Viscount Majors. Also used on the Fokker Friendship.

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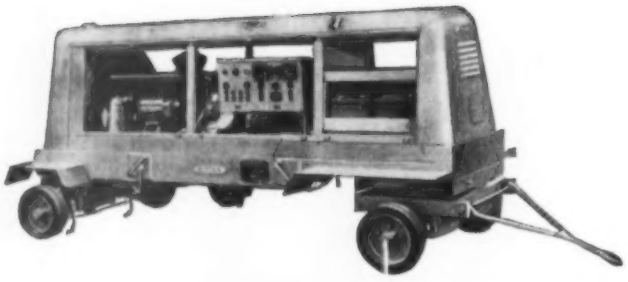
2nd-7th September
Private Day 2nd-4th
Public Day 5th-7th



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FOR STARTING AND SERVICING AIRCRAFT

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ANCILLARY INDUSTRY 1958...

FREIGHT HANDLING EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aerolex, Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Heston Aircraft and Associated Engineers, Ltd.
Mercury Airfield Equipment, Ltd.
Rollason Aerocessories, Ltd.
Ross, Ltd., S. Grahame
Samlesbury Engineering, Ltd.
Short Brothers and Harland, Ltd.
Teleflex Products, Ltd.

FREIGHT EQUIPMENT, AIRBORNE
Aviation Traders (Engineering), Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Latex Upholstery, Ltd.
Rollason Aerocessories, Ltd.
Samlesbury Engineering, Ltd.

FRICTION LININGS
Coin Insulation, Ltd.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
Sky-Lines Aircraft Components, Ltd.

FUELS, AIRCRAFT
BP Trading, Ltd.
Eagle Aircraft Services, Ltd.
Esso Petroleum Co., Ltd.
Mobil Oil Co., Ltd.
Shell-Mex and B.P., Ltd.
Skyways, Ltd.

FUELS, ROCKET, ETC.
British Oxygen Gases, Ltd.
Laporte Chemicals, Ltd.
Shell-Mex and B.P., Ltd.

FUELLING EQUIPMENT, AIRCRAFT
Aerocontacts (Ground Equipment), Ltd.
Avery-Hardoll, Ltd.
BP Trading, Ltd.
Boorn and Co., Ltd., Thomas
Exactor, Ltd.
Firth Cleveland Instruments, Ltd.
Flight Refuelling, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Hercules Engineering Co., Ltd., The
Lancefield Aircraft Components, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Plessey Co., Ltd., The
Rellumit (London), Ltd.
Saunders-Roe, Ltd.
Saunders Valve Co., Ltd.
Simmons and Hawker, Ltd.
Sky-Lines Aircraft Components, Ltd.
Thompson Bros. (Bilston), Ltd.
Wayne Tank and Pump Co., Ltd.
Zwicky, Ltd.

FUEL MEASUREMENT AND CALIBRATION EQUIPMENT
Amal, Ltd.
Bryans Aeroquipment, Ltd.
Elliott Brothers (London), Ltd.
Firth Cleveland Instruments, Ltd.
Flight Refuelling, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
H.M.L. (Engineering), Ltd.
Honeywell Controls, Ltd.
Integral, Ltd.
Kent, Ltd., George
Ketay, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Negretti and Zambra, Ltd.
Rotol, Ltd.
Scottish Distributors, Ltd.
Waymouth Gauges and Instruments, Ltd.
Wayne Tank and Pump Co., Ltd.

FUELLING EQUIPMENT, ROCKET, ETC.
Exactor, Ltd.
Flight Refuelling, Ltd.
Gloster Technical Developments,
Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Newton and Co., H. T.
Saunders-Roe, Ltd.
Saunders Valve Co., Ltd.

FUEL SYSTEMS, ENGINE
Dowty Fuel Systems, Ltd.
Gloster Aircraft Co., Ltd.
Hercules Engineering Co., Ltd., The
Hobson, Ltd., H. M.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Newton and Co., H. T.
Plessey Co., Ltd., The
Rover Gas Turbines, Ltd.

FURNISHING EQUIPMENT, AIRCRAFT
Aerolex, Ltd.
Aviation Traders (Engineering), Ltd.
Baynes Aircraft Interiors, Ltd.
Delaney Gallay, Ltd.
Eagle Aircraft Services, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Hickman, Ltd.
Irwin and Partners, Ltd., E. G.
Lancefield Aircraft Components, Ltd.
Latex Upholstery, Ltd.
Newton and Co., H.T.
Parnall and Co., Ltd., George
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.

FUSES
Aerocontacts (Sales), Ltd.
Belling and Lee, Ltd.
General Electric Co., Ltd., The
Newton and Co., H. T.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Wynn and Co. (Aircraft), Ltd., E. D.

GALLEY EQUIPMENT
Aerogalley
Airwork, Ltd.
Attewell and Sons, Ltd., B.
Aviation Traders (Engineering), Ltd.
Baynes Aircraft Interiors, Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hickman, Ltd.
Jablo Plastics Industries, Ltd.
Lancefield Aircraft Components, Ltd.
Lec Refrigeration, Ltd.
Ross, Ltd., S. Grahame
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.
Saunders Valve Co., Ltd.

GASES, LIQUIFIED
British Oxygen Gases, Ltd.
Esso Petroleum Co., Ltd.
Shell-Mex and B.P., Ltd.
Sparklets, Ltd.

GASES, LIQUIFIED, HANDLING EQUIPMENT FOR
British Oxygen Aro Equipment, Ltd.
Firth Cleveland Instruments, Ltd.
Honeywell Controls, Ltd.
Sparklets, Ltd.

GASKETS
Attewell and Sons, Ltd., B.
Bell's Asbestos and Engineering, Ltd.
Coin Insulation, Ltd.
Coopers Mechanical Joints, Ltd.
Dowty Seals, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Hall and Hall, Ltd.
Jablo Plastics Industries, Ltd.
Kautex, Ltd.
Long and Hambly, Ltd.
Precision Rubbers, Ltd.
Spencer Moulton and Co., Ltd., George
Trist and Co., Ltd., Ronald
Turner Brothers Asbestos Co., Ltd.
Vaughan and Co., Ltd., Edgar

GAUGES, STRAIN
Elliott Brothers (London), Ltd.
Fairey Aviation Co., Ltd., The
General Electric Co., Ltd., The
Kelvin and Hughes, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Racal Engineering, Ltd.
Research and Control Instruments, Ltd.
Saunders-Roe, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.

GEARS AND GEAR SYSTEMS
Bretts Precision Engineering Co., Ltd.
British Thomson-Houston Co., Ltd., The
Brown Industries (General Gear Division), Ltd., David
Brown, Ltd., S. G.
Centrax, Ltd.
Cinetra Manufacturing Co., Ltd.
Coin Insulation, Ltd.
E. N. V. Engineering Co., Ltd.
Gear Grinding Co., Ltd., The
Graseby Instruments, Ltd.
Ketay, Ltd.
Miles, Ltd., F. G.
Newmark, Ltd., Louis
Newton and Co., H. T.
Tiltman Langley, Ltd.
Vactric (Control Equipment), Ltd.

GENERATORS, ELECTRIC
Aerocontacts (Sales), Ltd.
Airline Air Spares, Ltd.
Andec, Ltd.
Aviation Traders (Engineering), Ltd.
British Thomson-Houston Co., Ltd., The
Centrax, Ltd.
Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd.
General Electric Co., Ltd., The
Newton and Co., H. T.
Newton Brothers (Derby), Ltd.
Parman Aircraft Supplies, Ltd.
Rotax, Ltd.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Vernons Industries, Ltd.
Walter, A. J.
Whittemore (Aeradio), Ltd., A. J.

GLASS, SAFETY
Eagle Aircraft Services, Ltd.
Sky-Lines Aircraft Components, Ltd.
Suntex Safety Glass Industries, Ltd.
Triplex Safety Glass Co., Ltd., The

GLIDER EQUIPMENT
British Oxygen Aro Equipment, Ltd.
Irving Air Chute of Great Britain, Ltd.
Newton and Co., H. T.

GRINDING EQUIPMENT (see also Tools, Machine)
Aerocontacts (Ground Equipment), Ltd.
Brockhouse and Co., Ltd., J.
Gear Grinding Co., Ltd., The
Leytonstone Jig and Tool Co., Ltd.
Scintilla, Ltd.
Scottish Distributors, Ltd.

GROUND POWER UNITS (see also Starters, engine)
Aerocontacts (Ground Equipment), Ltd.
Armstrong Siddeley Motors, Ltd.
Blackburn and General Aircraft, Ltd.
Centrax, Ltd.
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Houchin, Ltd.
Murex Welding Processes, Ltd.
Newton and Co., H. T.
Petbow, Ltd.
Plessey Co., Ltd., The
Rollason Aerocessories, Ltd.
Rotax, Ltd.
Rover Gas Turbines, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Venner Accumulators, Ltd.
Vernons Industries, Ltd.
Westinghouse Brake and Signal Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

GUIDED-WEAPON EQUIPMENT
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Avimo, Ltd.
Bradley, Ltd., G. and E.
Bristol Aircraft, Ltd.
British Oxygen Aro Equipment, Ltd.
British Thomson-Houston Co., Ltd., The
Brown, Ltd., S. G.
Cinetra Manufacturing Co., Ltd.,
de Havilland Propellers, Ltd.
Dobbie McInnes, Ltd.
Dowty Equipment, Ltd.
Dunlop Rubber Co., Ltd.

Refuelling a Canberra from 2½in hydrant pit (Avery-Hardoll, Ltd.).

E.M.I. Electronics, Ltd.
Electro-Hydraulics, Ltd.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd.
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
Flight Refuelling, Ltd.
General Electric Co., Ltd., The
Gloster Technical Developments
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
Integral, Ltd.
Irving Air Chute of Great Britain, Ltd.
Ketay, Ltd.
King Aircraft Corporation
Kingston Instrument Co., Ltd.
Leytonstone Jig and Tool Co., Ltd.
M.L. Aviation Co., Ltd.
McMichael Radio, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Portsmouth Aviation, Ltd.
Pullin and Co., Ltd., R. B.
Pye, Ltd.
Racal Engineering, Ltd.
Reid and Sigrist, Ltd.
Ross, Ltd., S. Grahame
Royston Instruments, Ltd.
Sanders (Electronics), Ltd., W. H.
Sankey and Sons, Ltd., Joseph
Saunders Valve Co., Ltd.
Scottish Distributors, Ltd.
Siebe, Gorman and Co., Ltd.
Solartron Electronic Group, Ltd., The
Southern Instruments, Ltd.
SPE Co., Ltd.
Specto, Ltd.
Spencer Moulton and Co., Ltd., George
Sperry Gyroscope Co., Ltd.
Straight-Lite Reflectors, Ltd.
Venner Accumulators, Ltd.
Vernons Industries, Ltd.
W.S. Electronics (Production), Ltd.
Western Manufacturing (Reading), Ltd.

GUNS—see Armament

GYRO SYSTEMS
A.J.W. (Instruments), Ltd.
Airline Air Spares, Ltd.
Brown, Ltd., S. G.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd.
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
Graseby Instruments, Ltd.
Honeywell Controls, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Ketay, Ltd.
Muirhead and Co., Ltd.

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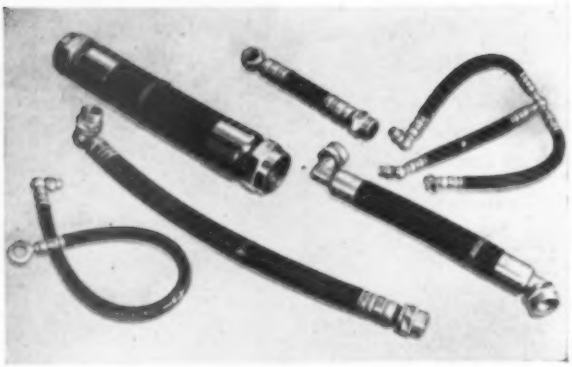
ADDRESSES OF COMPANIES: pages 374-380



Palmer Aero Products Silvoflex Type 200 hose units and connectors.

ANCILLARY INDUSTRY 1958...

Newmark, Ltd., Louis
Newton and Co., H. T.
Phillips and White, Ltd.
Pullin and Co., Ltd., R. B.
Reid and Sigrist, Ltd.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smiths Aircraft Instruments, Ltd.
Sperry Gyroscope Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.
Woodside Die Sinking Co., Ltd.

HAIR, RUBBERIZED
(for Packaging, upholstery, etc.)
Baynes Aircraft Industries, Ltd.
Cox and Son, Ltd., John
Eagle Aircraft Services, Ltd.
Hairlok Co., Ltd., The
Latex Upholstery, Ltd.

HANDLING EQUIPMENT, AIRCRAFT
(other than tractors)
Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Electro-Hydraulics, Ltd.
Gloster Technical Developments, Ltd.
Hooper and Co. (Coachbuilders), Ltd.
Lansing Bagnall, Ltd.
Leytonstone Jig and Tool Co., Ltd.
Mercury Airfield Equipment, Ltd.
Morfax, Ltd.
Parman Aircraft Supplies, Ltd.
Portsmouth Aviation, Ltd.
Rellumit (London), Ltd.
Rollason Aerocessories, Ltd.
Ross, Ltd., S. Grahame
Samlesbury Engineering, Ltd.
Saunders-Roe, Ltd.
Vernons Industries, Ltd.

HANGARS
Aerocontacts (Ground Equipment), Ltd.
Bellman Hangars
British Insulated Callender's Cables, Ltd.
Costain, Ltd., Richard

HANGARAGE
Airwork, Ltd.
British Aviation Services (Engineering), Ltd.
Eagle Aircraft Services, Ltd.
Warden Aviation and Engineering Co.

HARNESSES, AIRCREW AND FITTINGS
Aerocontacts (Sales), Ltd.
Aerolex, Ltd.
Aircraft Materials, Ltd.
G. Q. Parachute Co., Ltd.
Irving Air Chute of Great Britain, Ltd.
Lancefield Aircraft Components, Ltd.
M.L. Aviation Co., Ltd.
Newton and Co., H. T.
Rumbold and Co., Ltd., L. A.
Sky-Lines Aircraft Components, Ltd.
Teleflex Products, Ltd.

HARNESS, WIRING
Aerocontacts (Sales), Ltd.
Airline Air Spares, Ltd.
Andec, Ltd.
Astralux, Ltd.
Avica Equipment, Ltd.
E.R.S. (London), Ltd.
Electrocon, Ltd.
Ferranti (Meters), Ltd., Denis
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Plessey Co., Ltd., The
Rist's Wires and Cables, Ltd.
Rotax, Ltd.

HEATERS, AIRCRAFT
Aerocontacts (Ground Equipment), Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Copeland and Jenkins, Ltd.
Delaney Gallay, Ltd.
Dragonair, Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Godden (Cheltenham), Ltd., M. H.
Henshall and Sons (Addlestone), Ltd., W.
Marston Excelsior, Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.

HEATERS, HANGAR AND FACTORY
Aerocontacts (Ground Equipment), Ltd.
Cole, Ltd., E. K.
Dragonair, Ltd.
General Electric Co., Ltd., The
Hunting Mhoglas, Ltd.
Rover Gas Turbines, Ltd.

HEAT-EXCHANGERS
Centrax, Ltd.
Delaney Gallay, Ltd.
Dragonair, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Harvey and Co. (London), Ltd., G. A.
Lawrence, Ltd., J. W.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Marston Excelsior, Ltd.
Newton and Co., H. T.
Pipework and Engineering (Bristol), Ltd.
Sankey and Sons, Ltd., Joseph
Serck Radiators, Ltd.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.
Wilmot Breeden, Ltd.

HEAT-RESISTANT ALLOYS AND MATERIALS
(see also Steels, Ferrous Alloys, etc.)
Birkett, Billington and Newton, Ltd., T. M.
Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
Fox and Co., Ltd., Samuel
Hadfields, Ltd.
Jessop and Sons, Ltd., William
Low Moor Alloy Steelworks, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Midland Silicones, Ltd.
Rapp, Ltd., Leo
Wiggin and Co., Ltd., Henry

HEATING EQUIPMENT, INDUSTRIAL PROCESS
Aerocontacts (Ground Equipment), Ltd.
Centrax, Ltd.
Dragonair, Ltd.
Flint, Ltd. Howard
General Electric Co., Ltd., The
Godden (Moldings), Ltd., M. H
Hunting Mhoglas, Ltd.
Isopad, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Philips Electrical, Ltd.
Rover Gas Turbines, Ltd.
Royce Electric Furnaces, Ltd.

HELICOPTER AGENCIES AND SPARES
(see also Sales, Helicopter)
Dundas, Ltd., R. K.
Helicopter Sales, Ltd.
Hordern-Richmond (Sales), Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.

HONEYCOMB, METAL
Centrax, Ltd.
CIBA (A.R.L.), Ltd.
Delaney Gallay, Ltd.
Jablo Propellers, Ltd.
Short Brothers and Harland, Ltd.

HOSE, FLEXIBLE
Accles and Pollock, Ltd.
Aerocontacts (Sales), Ltd.
Airline Air Spares, Ltd.
Avica Equipment, Ltd.
Bell's Asbestos and Engineering, Ltd.
Boorn and Co., Ltd., Thomas
British Ermeto Corporation, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
High Pressure Components, Ltd.
King Aircraft Corporation
Lockheed Hydraulic Brake Co., Ltd., The
Maricon, Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Power Auxiliaries, Ltd.
Precision Rubbers, Ltd.
Skyhi, Ltd.
Siebe, Gorman and Co., Ltd.
Spencer Moulton and Co., Ltd., George
Super Oil Seals and Gaskets, Ltd.

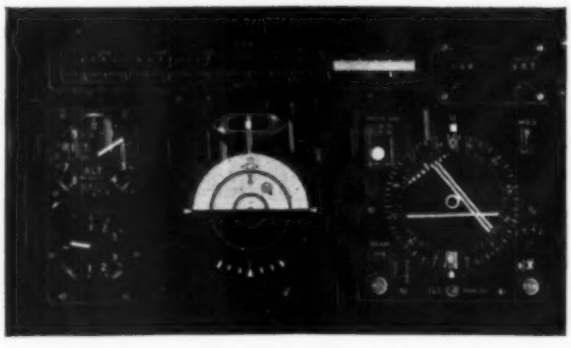
HYDRAULIC EQUIPMENT
Aero Maintenance Equipment, Ltd.
Aerocontacts (Sales), Ltd.
Airline Air Supplies, Ltd.
Astralux, Ltd.
Avica Equipment, Ltd.
Boulton Paul Aircraft, Ltd.
British Ermeto Corporation, Ltd.
British Messier, Ltd.
Clapham Park Motors, Ltd.
Dowty Equipment, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Exactor, Ltd.
Fairey Aviation Co., Ltd., The
Fawcett, Preston and Co., Ltd.
Ferranti (Meters), Ltd., Denis
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Hercules Engineering Co., Ltd., The
High Pressure Components, Ltd.
Hobson, Ltd., H. M.
Hymatic Engineering Co., Ltd., The
I.V. Pressure Controllers, Ltd.
Integral, Ltd.
Lancefield Aircraft Components, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Mollart Engineering Co., Ltd., The
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Power Jacks, Ltd.
Rollason Aerocessories, Ltd.
Saunders Valve Co., Ltd.
Short Brothers and Harland, Ltd.
Sperry Gyroscope Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.
Western Manufacturing (Reading), Ltd.
Wilmot Breeden, Ltd.

IGNITION EQUIPMENT
Aerocontacts (Sales), Ltd.
Airline Air Spares, Ltd.
Avica Equipment, Ltd.
British Thomson-Houston Co., Ltd., The
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
K.L.G. (Aviation Products)
Lodge Plugs, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Newton and Co., H. T.
Plessey Co., Ltd., The
Rotax, Ltd.
Scintilla, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

INSPECTION EQUIPMENT
Aerocontacts (Ground Equipment), Ltd.
Bryans Aeroquipment, Ltd.
General Electric Co., Ltd., The
Goulder and Sons, Ltd., J.
Heston Aircraft and Associated Engineers, Ltd.
Lancefield Aircraft Components, Ltd.
Leytonstone Jig and Tool Co., Ltd.
Mollart Engineering Co., Ltd., The
Newton and Co., H. T.
Optical Measuring Tools, Ltd.
Racal Engineering, Ltd.
Rollason Aerocessories, Ltd.
Scottish Distributors, Ltd.
Woodside Die Sinking Co., Ltd.

INSTRUMENTS, AIRCRAFT AND ENGINE
A. J. W. (Instruments), Ltd.
Aerocontacts (Sales), Ltd.
Aircraft Unit Engineering Co.
Astralux, Ltd.
Aviation Traders (Engineering), Ltd.
Avimo, Ltd.
Dobbie McInnes, Ltd.
Dowty Nucleonics, Ltd.
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Elliott Brothers (London), Ltd.
Ferranti, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Honeywell Controls, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Kent, Ltd., George
Ketay, Ltd.
Mechanism, Ltd.

Instruments of Kelvin Hughes flight data system.



ADDRESSES OF COMPANIES: pages 374-380

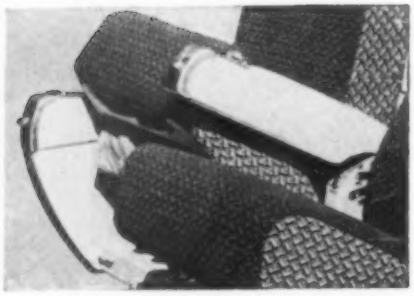
THE BLACKBURN NA.39 STRIKE AIRCRAFT

Blackburn and General Aircraft Limited. Brough. E. Yorks. England

A117/a

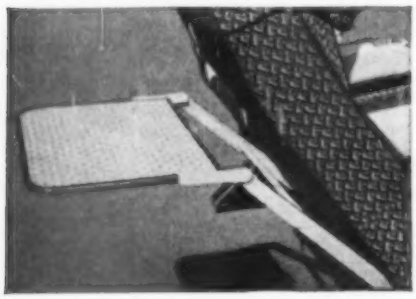
Triple "Traveller" showing three variations of headpiece.

Microcell



Tip-up seats make passenger access easier and simplify cleaning.

Tray tables remain in horizontal position and at constant height.



'Traveller' Seating

in Britannia and Comet IV aircraft

for **B·O·A·C**

★ **Tip-up seat for ease of access and cleaning**

★ **Tray tables remain at constant height**

★ **Folding leg to facilitate stowage when freighting**

★ **Interchangeable backs, arms, seat pans and legs**

★ **Single beam, unit construction**

Microcell Aircraft

A DIVISION OF MICROCELL LIMITED

Imperial Buildings, 56 Kingsway, London, W.C.2

Telephone: CHAncery 3424 (10 lines)
Telegrams: Microcell, Westcent, London

MA2

"Rotheswan" jack for lifting heavy aircraft. Brown Bros. (Aircraft), Ltd.

ANCILLARY INDUSTRY 1958..

Miles, Ltd., F. G.
Munro, Ltd., R. W.
Negretti and Zambra, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Phillips and White, Ltd.
Plessey Co., Ltd., The
Pullin and Co., Ltd., R. B.
Reid and Sigrist, Ltd.
Rotol, Ltd.
Sangamo Weston, Ltd.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smiths Aircraft Instruments, Ltd.
Sperry Gyroscope Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Venner, Ltd.
Walter, A. J.
Whittemore (Aeradio), Ltd., A. J.
Wynn and Co. (Aircraft), Ltd., E. D.
Z and I Aero Services, Ltd.

INSULATION, ELECTRICAL

Bakelite, Ltd.
British Thomson-Houston Co., Ltd., The
CIBA (A.R.L.), Ltd.
Coin Insulation, Ltd.
Copeland and Jenkins, Ltd.
Eagle Aircraft Services, Ltd.
Fibreglass, Ltd.
Fireproof Tanks, Ltd.
Fothergill and Harvey (Sales), Ltd.
General Electric Co., Ltd., The
Godden (Mouldings), Ltd., M. H.
Midland Silicones, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Newton and Co., H. T.
Siemens Edison Swan, Ltd.
Spencer Moulton and Co., Ltd., George
Tufnol, Ltd.

INSULATION, SOUND

Anticoustic Co., The
Baxter, Woodhouse and Taylor, Ltd.
Cullum and Co., Ltd., Horace W.
Fibreglass, Ltd.
Fireproof Tanks, Ltd.
Jablo Plastics Industries, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Newalls Insulation Co., Ltd.
Newton and Co., H. T.
Rumbold and Co., Ltd., L. A.
Soundrite, Ltd.

INSULATION, THERMAL

Baxter, Woodhouse and Taylor, Ltd.
Bell's Asbestos and Engineering, Ltd.
British Refrasil Co., Ltd.
Coin Insulation, Ltd.
Delaney Gallay, Ltd.
Fibreglass, Ltd.
Fireproof Tanks, Ltd.
Flint, Ltd., Howard
Jablo Plastics Industries, Ltd.
Midland Silicones, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Newalls Insulation Co., Ltd.
Newton and Co., H. T.
Rumbold and Co., Ltd., L. A.
Spencer Moulton and Co., Ltd., George
Thermo Plastics, Ltd.

INSURANCE

British Aviation Insurance Co., Ltd., The
Helicopter Sales, Ltd.
Sky-Lines Aircraft Components, Ltd.

JACKS (AIRCRAFT COMPONENT)

Aerocontacts (Aircraft Distributors), Ltd.
Aero Controls, Ltd.
Aviation Traders (Engineering), Ltd.
British Messier, Ltd.
Brown Brothers (Aircraft), Ltd.
Dowty Equipment, Ltd
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Fairey Aviation Co., Ltd., The
Gloster Technical Developments
Hercules Engineering Co., Ltd., The
Hymatic Engineering Co., Ltd., The
Leytonstone Jig and Tool Co., Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Rotax, Ltd.
Rotol, Ltd.
Sky-Lines Aircraft Components, Ltd.
Teleflex Products, Ltd.
Walter, A. J.
Westminster Airways Servicing, Ltd.

JACKS (LIFTING, FOR MAINTENANCE, ETC.)

Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Brown Brothers (Aircraft), Ltd.
Clapham Park Motors, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Gloster Technical Developments
H.M.L. (Engineering), Ltd.
Hercules Engineering Co., Ltd., The
Leytonstone Jig and Tool Co., Ltd.
Mercury Airfield Equipment
Morfax, Ltd.
Newton and Co., H. T.
Parman Aircraft Suplies, Ltd.
Power Jacks, Ltd.
Skyhi, Ltd.
Westminster Airways Servicing, Ltd.

JIGS AND FIXTURES

Abbey Panel and Sheet Metal Co., Ltd., The
Aero Controls, Ltd.
Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Astralux, Ltd.
Attewell and Sons, Ltd., B.
Aviation Traders (Engineering), Ltd.
Bell Precision Engineering Co., Ltd.
Blake (Brentwood), Ltd., Geo. A.
Bretts Precision Engineering Co., Ltd.
Burgess and Co., Ltd., G. N.
C.J.C. Developments (Portsmouth), Ltd.
Centrax, Ltd.
Coin Insulation, Ltd.
Cornercroft, Ltd.
Fairey Aviation Co., Ltd., The
Folland Aircraft, Ltd.
Gloster Engineering (Cheltenham), Ltd.
Goulder and Sons, Ltd., J.
Headland Engineering Developments, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Heston Aircraft and Associated Engineers, Ltd.
Hines (Engineers), Ltd., Edward
Hooper and Co. (Coachbuilders), Ltd.
Hordern-Richmond (Sales), Ltd.
I. V. Pressure Controllers, Ltd.
Jameson, Ltd., J. L.
Jig Design and Engineering Co.
Keim Engineering, Ltd.
Kingston Instrument Co., Ltd.
London Production Tools, Ltd.
Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Morfax, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
North West Machine Design Co., Ltd.
Pipework and Engineering (Bristol), Ltd.
Purejoy Unit Tooling, Ltd., J. B.
Redwing, Ltd.
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.
Spa Guilds, Ltd.
Walker (A.D), Ltd., James
Western Manufacturing (Reading), Ltd.
Westminster Airways Servicing, Ltd.
Woodside Die Sinking Co., Ltd.

JIGS AND FIXTURES, STANDARD PARTS FOR CONSTRUCTION OF

C.J.C. Developments (Portsmouth), Ltd.
Hercules Engineering Co., Ltd., The
Hordern-Richmond, Ltd.
I. V. Pressure Controllers, Ltd.
London Production Tools, Ltd.
Miles, Ltd, F. G.
Purefoy Unit Tooling, Ltd., J. B.
Samlesbury Engineering, Ltd.
Western Manufacturing (Reading), Ltd.
Woodside Die Sinking Co., Ltd.

JOINTING MATERIALS AND COMPOUNDS

(see also Gaskets, Seals, Sealants, and Sealants, Runway Jointing)

Aircraft Materials, Ltd.
Attewell and Sons, Ltd., B.
Bell's Asbestos and Engineering, Ltd.
Brown Brothers (Aircraft), Ltd.
Cellon, Ltd.
Coin Insulation, Ltd.
Coopers Mechanical Joints, Ltd.
Docker Brothers
Dowty Seals, Ltd.
Dunlop Rubber Co., Ltd.
Fireproof Tanks, Ltd.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
Hall and Hall, Ltd.
Jablo Propellers, Ltd.
Kane, Ltd., Douglas
Kautex, Ltd.
Kenilworth Manufacturing Co., Ltd., The
Leytonstone Jig and Tool, Ltd.
Midland Silicones, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Ryland, Ltd., Llewellyn
Spencer Moulton and Co., Ltd., George
Telegraph Construction and Maintenance Co., Ltd., The
Titanine, Ltd.
Trist and Co., Ltd., Ronald
Turner Brothers Asbestos Co., Ltd.
Vaughan and Co., Ltd., Edgar
Wills Pressure Filled Joint Ring, Ltd.

JOINTS, UNIVERSAL

Aero Controls, Ltd.
Amal, Ltd.
B.R.D. Co., Ltd.
Eagle Aircraft Services, Ltd.
Hardy Spicer, Ltd.
Laycock Engineering, Ltd.
Mollart Engineering Co., Ltd., The
Spencer Moulton and Co., Ltd., George

LABORATORY EQUIPMENT

(see also Test Equipment)

Aircraft Materials, Ltd.
Andec, Ltd.
Bryans Aeroquipment, Ltd.
Dawe Instruments, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Fawcett, Preston and Co., Ltd.
Ferranti (Meters), Ltd., Denis
Gloster Technical Developments
Goodmans Industries, Ltd.
Graseby Instruments, Ltd.
H.M.L. (Engineering), Ltd.
Hendrey Relays, Ltd.
Honeywell Controls, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Muirhead and Co., Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Racal Engineering, Ltd.
Rollason Aerocessories, Ltd.
Sanders (Electronics), Ltd., W. H.
Scottish Distributors, Ltd.
Short and Mason, Ltd.
Southern Instruments, Ltd.
Wayne Kerr Laboratories, Ltd.
Whittemore (Aeradio), Ltd., A. J.

LADDERS

Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Clapham Park Motors, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Lancefield Aircraft Components, Ltd.
Mercury Airfield Equipment, Ltd.
Rellumit (London), Ltd.

LANDING GEAR

Aviation Traders (Engineering), Ltd.
Boulton Paul Aircraft, Ltd.
British Messier, Ltd.
Dowty Equipment, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Fairey Aviation Co., Ltd., The
Hercules Engineering Co., Ltd., The
Hooper and Co. (Coachbuilders), Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Newton and Co., H. T.
Rotol, Ltd.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.

LEAD

Birkett, Billington and Newton, Ltd.
Coley and Son (Hounslow), Ltd., R. J.
Imperial Chemical Industries, Ltd.

LEATHER FOR UPHOLSTERY AND PANELLING, ETC.

Connolly Bros. (Curriers), Ltd.
Latex Upholstery, Ltd.

LIFEJACKETS

Aerocontacts (Sales), Ltd.
Elliot Equipment, Ltd.
Flint, Ltd., Howard.
Frankenstein and Sons (Manchester), Ltd., P.
Jablo Plastics Industries, Ltd.
Newton and Co., H. T.
R.F.D. Co., Ltd.

LIFE-SAVING EQUIPMENT OTHER THAN SPECIFIED ITEMS

Adam and Lane and Neeve, Ltd.
Aerocontacts (Sales), Ltd.
Aerolex, Ltd.
Aircraft Materials, Ltd.
Baxter, Woodhouse and Taylor, Ltd
Burndept, Ltd.
Dunlop Rubber Co., Ltd.
Elliot Equipment, Ltd.
Ferranti (Meters), Ltd., Denis
Flint, Ltd., Howard
Frankenstein and Sons (Manchester), Ltd., P.
Irving Air Chute of Great Britain, Ltd.
Jablo Plastics Industries, Ltd.
Kidde Co., Ltd., Walter, The
Latex Upholstery, Ltd.

Continued overleaf

Passenger emergency-escape chute (Latex Upholstery, Ltd.).

ANCILLARY INDUSTRY 1958...

M.L. Aviation Co., Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
R.F.D. Co., Ltd.
Siebe, Gorman and Co., Ltd.,
Sparklets, Ltd.
Ultra Electric, Ltd.

LIGHTING EQUIPMENT, AIRCRAFT

Aerocontacts (Sales), Ltd.
Blackburn and General Aircraft, Ltd.
British Thomson-Houston Co., Ltd., The
Ceag, Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Gloster Technical Developments
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Philips Electrical, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Siemens Edison Swan, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Suntex Safety Glass Industries, Ltd.
Thorn Electrical Industries, Ltd.
Venner, Ltd.

LIGHTING EQUIPMENT, AIRFIELD

Aerocontacts (Ground Equipment), Ltd.
British Thomson-Houston Co., Ltd., The
Ceag, Ltd.
General Electric Co., Ltd., The
Harley Aircraft Landing Lamps
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Philips Electrical, Ltd.
Reliance Cords and Cables, Ltd.
Siemens Edison Swan, Ltd.
Standard Telephones and Cables, Ltd.

LIGHTING EQUIPMENT, FACTORY AND OFFICE

Aerocontacts (Ground Equipment), Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
British Thomson-Houston Co. Ltd., The
Ceag, Ltd.
C.W.C. Equipment, Ltd.
General Electric Co., Ltd., The
Harley Aircraft Landing Lamps
Philips Electrical, Ltd.
Siemens Edison Swan, Ltd.
Suntex Safety Glass Industries, Ltd.

LOCK WASHERS, LEAKPROOF

Aircraft Materials, Ltd.
Brown Brothers (Aircraft), Ltd.
Eagle Aircraft Services, Ltd.
Kane, Ltd., Douglas
Newton and Co., H. T.

LOCKNUTS

Aerocontacts (Sales), Ltd.
Aeronautical Traders and Mfg. Co., Ltd.
Aircraft Materials, Ltd.
Aviation Developments, Ltd.
Bretts Precision Engineering Co., Ltd.
Brown Brothers (Aircraft), Ltd.
Carr Fastener Co., Ltd.
Eagle Aircraft Services, Ltd.
Firth Cleveland Instruments, Ltd.
Guest, Keen and Nettlefolds (Midlands), Ltd.
Kane, Ltd., Douglas
Miller Aviation, Ltd.
Newton and Co., Ltd., L. H.
Ross, Courtney and Co., Ltd.
Simmonds Aerocessories, Ltd.
Whitehouse Industries, Ltd.

LOCKS, DOOR

Baynes Aircraft Interiors, Ltd.
King Aircraft Corporation
Newton and Co., H. T.
Ross, Ltd., S. Grahame

LUBRICANTS

Aircraft Materials, Ltd.
Eagle Aircraft Services, Ltd.
Esso Petroleum Co., Ltd., The
Magnus Chemical Co., Ltd.
Manchester Oil Refinery (Sales), Ltd.
Midland Silicones, Ltd.
Mobil Oil Co., Ltd.
Regent Oil Co., Ltd.
Shell-Mex and BP, Ltd.
Sky-Lines Aircraft Components, Ltd.
Vaughan and Co., Ltd., Edgar
Wakefield and Co., Ltd., C. C.
Wakefield-Dick Industrial Oils, Ltd.

LUBRICATING EQUIPMENT FOR SERVICING

Aerocontacts (Ground Equipment), Ltd.
Exactor, Ltd.
Rellumit (London), Ltd.
Tecalemit, Ltd.
Wakefield and Co., Ltd., C. C.
Wakefield-Dick Industrial Oils, Ltd.

MAGNESIUM AND ITS ALLOYS

Birmetals, Ltd.
Booth and Co., Ltd., James
High Duty Alloys, Ltd.
Kent Alloys, Ltd.
Magnesium Elektron, Ltd.
Rapp, Ltd., Leo
Rollet and Co., Ltd., H.
Sterling Metals, Ltd.
Stone and Co. (Charlton), Ltd., J.
Wilson and Sons (London), Ltd., W.

MAGNETOS

Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
British Thomson-Houston Co., Ltd., The
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Newton and Co., H. T.
Rollason Aircraft and Engines, Ltd.
Rotax, Ltd.
Skylines Aircraft Components, Ltd.
Walter, A. J.
Whittemore (Aeradio), Ltd., A. J.

MAPS

Fairey Air Surveys, Ltd.
Foldex, Ltd.
Hunting Aerosurveys, Ltd.
International Aeradio, Ltd.
Meridan Airmaps, Ltd.
Newton and Co., H. T.

MARINE AIRCRAFT SERVICING EQUIPMENT

Hercules Engineering Co., Ltd., The
Newton and Co., H. T.
Ross, Ltd., S. Grahame

MARINE CRAFT

Air Service Training, Ltd.
Elliot Equipment, Ltd.
Fairey Aviation Co., Ltd., The
Fairey Marine, Ltd
Jablo Plastics Industries, Ltd.
Thornycroft and Co., Ltd., John I.
Vosper, Ltd.

MATTING, WING WALKWAY

Aerocontacts (Ground Equipment), Ltd.
British Aluminium Co., Ltd., The
Fireproof Tanks, Ltd.
Latex Upholstery, Ltd.
Palmer Aero Products, Ltd.
Westminster Airways Servicing, Ltd.

MECHANICAL HANDLING EQUIPMENT (other than Tractors; Trucks; Handling Equipment, Aircraft)

Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Eccles (Birmingham), Ltd.
Hercules Engineering Co., Ltd., The
Heston Aircraft and Associated Engineers, Ltd.
Lansing Bagnall, Ltd.
M.L. Aviation Co., Ltd.
Mercury Airfield Equipment, Ltd.
Portsmouth Aviation, Ltd.
Ross, Ltd., S. Grahame
Short Brothers and Harland, Ltd.
Solartron Electronic Group, Ltd., The
Teleflex Products, Ltd.
Wayne Tank and Pump Co., Ltd.

METAL DEPOSITION (other than plating, electro-)

Albright and Wilson (Mfg.), Ltd.
Atlas Plating Works, Ltd.

METAL SPRAYING AND EQUIPMENT

Aerocontacts (Ground Equipment), Ltd.
Eagle Aircraft Services, Ltd.
Mining and Chemical Products, Ltd.
Siebe, Gorman and Co., Ltd.
Walterisation Co., Ltd., The

METEOROLOGICAL INSTRUMENTS AND EQUIPMENT

Decca Radar, Ltd.
Munro, Ltd., R. W.
Negretti and Zambra, Ltd.
Newton and Co., H. T.
Scottish Distributors, Ltd.
Short and Mason, Ltd.

MICROPHONES

Aerocontacts (Sales), Ltd.
Airmed, Ltd.
Brown, Ltd., S. G.
Eagle Aircraft Services, Ltd.
Ecko Electronics, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Philips Electrical, Ltd.
Pye Telecommunications, Ltd.
Soundrite, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

MISSILE EQUIPMENT (see Guided-weapon equipment)

MODELS, DISPLAY AND WIND TUNNEL, ETC.

Aerocontacts (Sales), Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Burgess and Co., Ltd., G. N.
Gloster Technical Developments
Hunting Aerosurveys, Ltd. (Models Div.)
Newton and Co., H. T.
Saunders-Roe, Ltd.
Westway Models, Ltd.
Woodside Die Sinking Co., Ltd.

MOTORS, ELECTRIC

Andec, Ltd.
Aviation Traders (Engineering), Ltd.
British Thomson-Houston Co., Ltd., The
Brown, Ltd., S. G.
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd.
General Electric Co., Ltd., The
Honeywell Controls, Ltd.
Kelvin and Hughes, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Kent, Ltd., George
Ketay, Ltd.
Metachemical Processes, Ltd.
Muirhead and Co., Ltd.
Newton and Co., H. T.
Plessey Co., Ltd., The
Pullin and Co., Ltd., R. B.
Rotax, Ltd.
Rotol, Ltd.
Scottish Distributors, Ltd.
Smith's Aircraft Instruments, Ltd.
Specto, Ltd.
Vactric (Control Equipment), Ltd.
Vernons Industries, Ltd.
Western Manufacturing (Reading), Ltd.
Whittemore (Aeradio), Ltd., A. J.

MOUNTINGS, SHOCK-ABSORBING

Aviation Traders (Engineering), Ltd.
Cementation (Muffelite), Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
Fairey Air Surveys, Ltd.
Fireproof Tanks, Ltd.
Newton and Co., H. T.
St. Helens Cable and Rubber Co., Ltd.
Sky-Lines Aircraft Components, Ltd.
Spencer Moulton and Co., Ltd., George
Whittemore (Aeradio), Ltd., A. J.
Williamson Manufacturing Co., Ltd.

MUFFLERS, GROUND, FOR JET ENGINES

Aerocontacts (Ground Equipment), Ltd.
Cementation (Muffelite), Ltd.
Cullum and Co., Ltd., Horace W.
Curran, Ltd., John
Detuners, Ltd.
Morfax, Ltd.

NAMEPLATES

Bakelite, Ltd.
Brown, Ltd., S. G.
Coin Insulation, Ltd.
Eagle Aircraft Services, Ltd.
Ferranti (Meters), Ltd., Denis
Kaylee Transfers, Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Rumbold and Co., Ltd., L. A.
Straight-Lite Reflectors, Ltd.
Whittemore (Aeradio), Ltd., A. J.

NAVIGATIONAL INSTRUMENTS OTHER THAN RADIO AND RADAR

Aeronautical Trades and Mfg. Co., Ltd.
Airline Air Spares, Ltd.
Cossor, Ltd., A. C.
Decca Navigator Co., Ltd., The
Dobbie McInnes, Ltd.
Elliott Brothers (London), Ltd.
Ferranti, Ltd.
Gloster Technical Developments
Kelvin and Hughes (Aviation), Ltd.
Ketay, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Munro, Ltd., R. W.
Newmark, Ltd., Louis
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Pullin and Co., Ltd., R. B.
Pye Telecommunications, Ltd.
Sangamo Weston, Ltd.
Scottish Distributors, Ltd.
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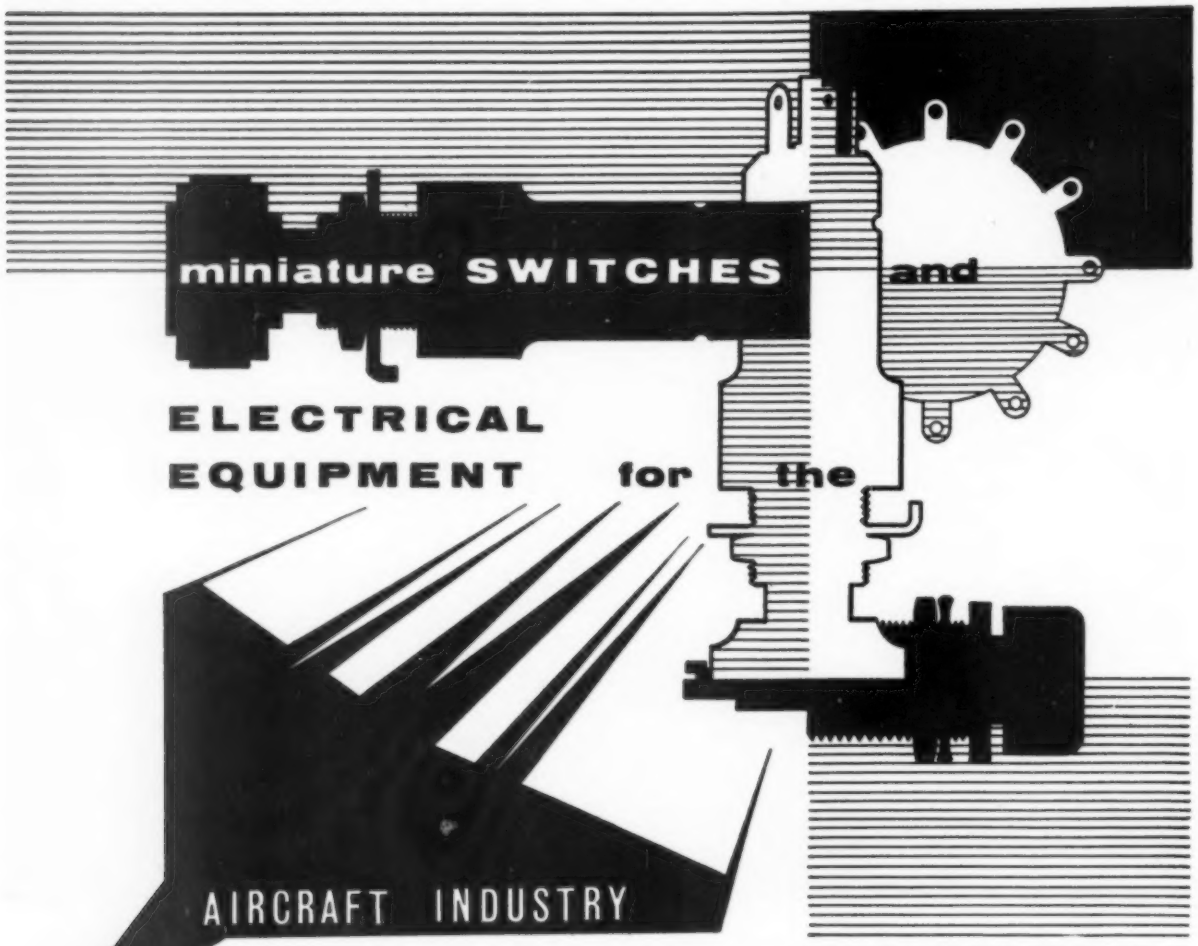

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Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.

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Specto, Ltd.

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Airwork, Ltd.
de Havilland Engine Co., Ltd., The
Dowty Nucleonics, Ltd.
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Hants and Sussex Aviation, Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Rollason Aircraft and Engines, Ltd.
Vosper, Ltd.

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Frankenstein and Sons (Manchester), Ltd., P.
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Spencer Moulton and Co., Ltd., George
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Hairlok Co., Ltd., The
Newton and Co., H. T.
Reynolds (Packaging), Ltd.
Xetal Products, Ltd.

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Rotax, Ltd.
Salter and Co., Ltd., Geo.
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G.Q. Parachute Co., Ltd.
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Jig Design and Engineering Co., Ltd.
Kelston Engineering Co., Ltd.
Kigass, Ltd.
King Aircraft Corporation
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Leytonstone Jig and Tool Co., Ltd.
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Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Morfax, Ltd.
Newton and Co., L. H.
Pearson Brothers (Engineers), Ltd.
Pipework and Engineering (Bristol), Ltd.
Plessey Co., Ltd., The
Presland and Partners, Ltd.
Redwing, Ltd.
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Spa Guilds, Ltd.
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Woodside Die Sinking Co., Ltd.
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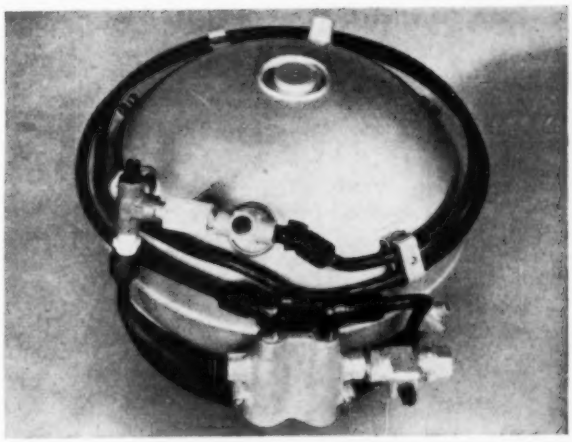
Aviation Traders (Engineering), Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The



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Vinten, Ltd., W.

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Ilford, Ltd.
Miles, Ltd., F. G.
Scottish Distributors, Ltd.

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Eagle Aircraft Services, Ltd.
Hepworth and Grandage (Yeadon), Ltd.
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Wellworthy, Ltd.

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Kane, Ltd., Douglas
Kenilworth Manufacturing Co., Ltd.
Wills Pressure Filled Joint Ring, Ltd.

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Bristol Aircraft, Ltd.
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General Electric Co., Ltd., The
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Microcell, Ltd.
Miles, Ltd., F. G.
Miles Structural Plastics, Ltd.
Parnall and Co., Ltd., George
Siemens Edison Swan, Ltd.
Suntex Safety Glass Industries, Ltd.
Thermo-Plastics, Ltd.
Triplex Safety Glass Co., Ltd.
Tufnol, Ltd.
Turner Electrical Instruments, Ltd., Ernest
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Wills Pressure Filled Joint Ring, Ltd.

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Coin Insulation, Ltd.
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Godden Mouldings, Ltd., M. H.
Hordern-Richmond (Sales), Ltd.
Jablo Plastics Industries, Ltd.
Jig Design and Engineering Co., Ltd.
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King Aircraft Corporation
Marston Excelsior, Ltd.
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Uhlhorn Bros., Ltd.
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Fireproof Tanks, Ltd.
Jablo Plastics Industries, Ltd.
Marston Excelsior, Ltd.
Microcell, Ltd.
Miles, Ltd., F. G.
Miles Structural Plastics, Ltd.
Siemens Edison Swan, Ltd.
Telegraph Construction and Maintenance Co., Ltd., The
Thermo-Plastics, Ltd.
Tufnol, Ltd.
Uhlhorn Bros., Ltd.
Wills Pressure Filled Joint Ring, Ltd.

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Bristol Aircraft, Ltd.
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Cole, Ltd., E. K.
Cornercroft, Ltd.
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Dowty Seals, Ltd.
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Ferranti (Meters), Ltd., Denis
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Tufnol, Ltd.
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Kodak, Ltd.
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Ryland, Ltd., Llewellyn
Uhlhorn Bros., Ltd.
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Fireproof Tanks, Ltd.
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Jablo Plastics Industries, Ltd.
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Saro Laminated Wood Products, Ltd.
Saunders-Roe, Ltd.
Siemens Edison Swan, Ltd.
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Thermo-Plastics, Ltd.
Tufnol, Ltd.
Uhlhorn Bros., Ltd.
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Newmark, Ltd., Louis
Siebe, Gorman and Co., Ltd.
Specto, Ltd.
Stuart (London), Ltd., Robert
Technical Platings, Ltd.
Turner Electrical Instruments, Ltd., Ernest

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Newton and Co., H. T.
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Walter, A. J.
Whittemore (Aeradio), Ltd., A. J.

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Newton and Co., H. T.
Reynolds (Packaging), Ltd.
Saro Laminated Wood Products, Ltd.

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Fairey Aviation Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Headland Engineering Developments
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
I. V. Pressure Controllers, Ltd.
Kidde Co., Ltd., The Walter
Lacy-Hulbert and Co., Ltd.
M.L. Aviation, Ltd.
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Rollason Aerocessories, Ltd.
Rotax, Ltd.

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Keim Engineering Co., Ltd.
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Normalair, Ltd.
Reynolds Tube Co., Ltd.
Siebe, Gorman and Co., Ltd.
Williams and James (Engineers), Ltd.

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Terry and Sons, Ltd., Herbert
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Western Mfg. (Reading), Ltd.
Wilmot Breeden, Ltd.

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E.M.I. Electronics, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
General Electric Co., Ltd., The
McMichael Radio, Ltd.
Metachemical Processes, Ltd.
Murphy Radio, Ltd.
Newmark, Ltd., Louis
Plessey Co., Ltd., The
Siemens Edison Swan, Ltd.
Soundrite, Ltd.
Sperry Gyroscope Co., Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.

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Aerocontacts (Sales), Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
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Aviation Traders (Engineering), Ltd.
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Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Hordern-Richmond (Sales), Ltd.
Metachemical Processes, Ltd.
Morfax, Ltd.
Newton and Co., H. T.
Rotol, Ltd.
Sky-Lines Aircraft Components, Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.
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Docker Brothers
Esso Petroleum Co., Ltd.
Export Packing Service, Ltd.
Fireproof Tanks, Ltd.
Hall and Sons (Bristol and London), Ltd., John
Hooper and Co. (Coachbuilders), Ltd.
Kenilworth Manufacturing Co., Ltd., The
Pyrene Co., Ltd., The
Reynolds (Packaging), Ltd.
Stuart (London), Ltd., Robert
Technical Platings, Ltd.
Valay Industries, Ltd.
Walterisation Co., Ltd., The

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International Aeradio, Ltd.
London School of Air Navigation, The
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Pitman and Sons, Sir Isaac
Putnam and Co., Ltd.

PUBLIC ADDRESS EQUIPMENT, AIRBORNE

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General Electric Co., Ltd., The
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Philips Electrical, Ltd.
Pye Telecommunications, Ltd.
Redifon, Ltd.
Soundrite, Ltd.
Standard Telephones and Cables, Ltd.
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Whittemore (Aeradio), Ltd., A. J.

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General Electric Co., Ltd., The
Goodmans Industries, Ltd.
Philips Electrical, Ltd.
Pye Telecommunications, Ltd.
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Gloster Aircraft Co., Ltd.
Hercules Engineering Co., Ltd., The
Hobson, Ltd., H. M.
Integral, Ltd.
Kigass, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Pulsometer Engineering Co., Ltd., The
Rover Gas Turbines, Ltd.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
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Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.
Wayne Tank and Pump Co., Ltd.
Zwicky, Ltd.

PUMPS, HYDRAULIC

Aero Maintenance Equipment, Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
Boulton Paul Aircraft, Ltd.
British Messier, Ltd.
Clapham Park Motors, Ltd.
Dowty Equipment, Ltd.
Electro-Hydraulics, Ltd.
Fawcett, Preston and Co., Ltd.
Gloster Aircraft Co., Ltd.
H.M.L. (Engineering), Ltd.
Hercules Engineering Co., Ltd., The
Hobson, Ltd., H. M.
Integral, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Rotol, Ltd.
Rover Gas Turbines, Ltd.
Scottish Distributors, Ltd.
Short Brothers and Harland, Ltd.
Skyhi, Ltd.
Sky-Lines Aircraft Components, Ltd.
Sperry Gyroscope Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.
Wayne Tank and Pump Co., Ltd.
Weyburn Engineering Co., Ltd.
Williams and James (Engineers), Ltd.

PYROTECHNICS

Aerocontacts (Sales), Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Schermuly Pistol Rocket Apparatus, Ltd., The
Y.S.C., Ltd., The

RADAR EQUIPMENT AND COMPONENTS

Aerocontacts (Sales), Ltd.
Andec, Ltd.
Belling and Lee, Ltd.
Blake (Brentwood), Ltd., Geo. A.
Bradley, Ltd., G. and E.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Cossor Radar and Electronics, Ltd.
Decca Radar, Ltd.
E.M.I. Electronics, Ltd.
E.R.S. (London), Ltd.
Ekco Electronics, Ltd.
Elliott Brothers (London), Ltd.
Ferranti, Ltd.
General Electric Co., Ltd., The
International Aeradio, Ltd.
Ketay, Ltd.
Lancefield Aircraft Components, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Morfax, Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Potter, Ltd., Walter
Scottish Distributors, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Tecalemit, Ltd.
Whittemore (Aeradio), Ltd., A. J.

RADIO EQUIPMENT AND COMPONENTS

Aerocontacts (Sales), Ltd.
Airmed, Ltd.
Airwork, Ltd.
Andec, Ltd.
Anticoustic Co., The
Aviation Traders (Engineering), Ltd.
Belling and Lee, Ltd.
Blake (Brentwood), Ltd., Geo. A.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
Brush Crystal Co., Ltd.
Burndept, Ltd.
Carr Fastener Co., Ltd.
de Havilland Propellers, Ltd.
Decca Navigator Co., Ltd., The
E.M.I. Electronics, Ltd.
E.R.S. (London), Ltd.
Ekco Electronics, Ltd.
Elliott Brothers (London), Ltd.
General Electric Co., Ltd., The
International Aeradio, Ltd.
Irish Air Charter, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
McMichael Radio, Ltd.
Morfax, Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Pye Telecommunications, Ltd.
Racal Engineering, Ltd.
Redifon, Ltd.
Sanders (Electronics), Ltd., W. H.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
Soundrite, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Tecalemit, Ltd.
Whittemore (Aeradio), Ltd., A. J.

RADIO AND RADAR INSTALLATIONS, PLANNING AND SUPPLY OF

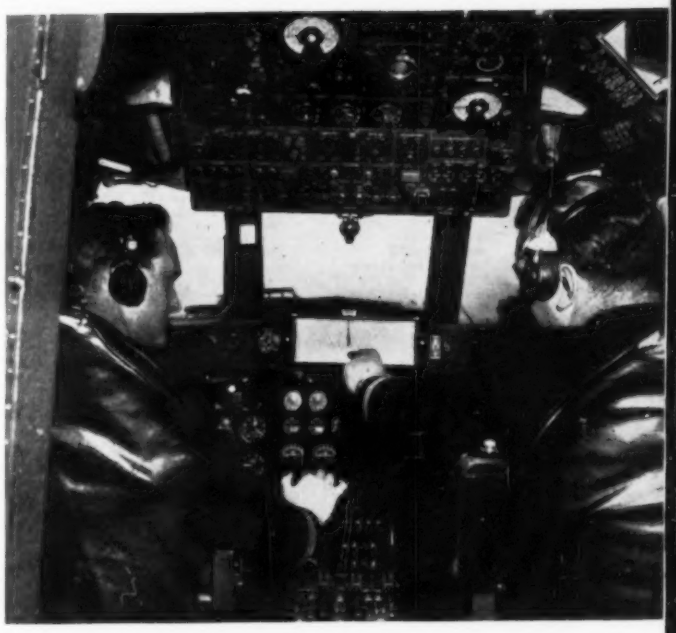
Airwork, Ltd.
Aviation Traders (Engineering), Ltd.
British Thomson-Houston Co., Ltd., The
Cossor Radar and Electronics, Ltd.
E.M.I. Electronics, Ltd.
Eagle Aircraft Services, Ltd.
Ekco Electronics, Ltd.
General Electric Co., Ltd., The
International Aeradio, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Miles, Ltd., F. G.
Murphy Radio, Ltd.
Newton and Co., H. T.
Plessey Co., Ltd., The
Pye Telecommunications, Ltd.
Redifon, Ltd.
Soundrite, Ltd.
Standard Telephones and Cables, Ltd.
Ultra Electric, Ltd.
Whittemore (Aeradio), Ltd., A. J.

RADIOGRAPHY AND X-RAY EQUIPMENT

General Electric Co., Ltd., The
Ilford, Ltd.
Kodak, Ltd.
Marconi Instruments, Ltd.
Newton and Co., H. T.
Research and Control Instruments, Ltd.

RADOMES

Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Fairey Aviation Co., Ltd., The
Fairey Marine, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Handley Page, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Marston Excelsior, Ltd.
Miles, Ltd., F. G.
Miles Structural Plastics, Ltd.
Newton and Co., H. T.
Thermo-Plastics, Ltd.



Decca Navigator Flight Log in a Viscount 802 of B.E.A.

RECORDERS, SOUND

Minnesota Mining and Manufacturing Co., Ltd.
Newton and Co., H. T.
Philips Electrical, Ltd.
Scottish Distributors, Ltd.
Soundrite, Ltd.
Thermionic Products, Ltd.

RECTIFIERS

Aerocontacts (Ground Equipment), Ltd.
British Thomson-Houston Co., Ltd., The
Eagle Aircraft Services, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd., The
Newton and Co., H. T.
Research and Control Instruments, Ltd.
Salford Electrical Instruments, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Westinghouse Brake and Signal Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

REFRACTORY MATERIALS

British Refrasil Co., Ltd., The
Delaney Gallay, Ltd.
Newton and Co., H. T.

REFUELLERS—see Fuelling Equipment

RELAYS, ELECTRICAL

Aerocontacts (Sales), Ltd.
Andec, Ltd.
British Thomson-Houston Co., Ltd., The
"Diamond H" Switches, Ltd.
E.M.I. Electronics, Ltd.
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd.
Ericsson Telephones, Ltd.
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Irwin and Partners, Ltd., E.
Measuring Instruments (Pullin), Ltd.
Newton and Co., H. T.
Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Pullin and Co., Ltd., R. B.
Rotax, Ltd.
Sanders (Electronics), Ltd., W. H.
Sangamo Weston, Ltd.
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Sky-Lines Aircraft Components, Ltd.
Smiths Aircraft Instruments, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Western Manufacturing (Reading), Ltd.
Whittemore (Aeradio), Ltd.

RELEASES, PARACHUTE, DROP-TANK, ETC.

Aerolex, Ltd.
Aircraft Materials, Ltd.
Aviation Developments, Ltd.
Ferranti (Meters), Ltd., Denis
Irving Air Chute of Great Britain, Ltd.
M.L. Aviation Co., Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Redwing, Ltd.
Rollason Aerocessories, Ltd.
Short Brothers and Harland, Ltd.

REPAIR, AIRFRAME

Air Service Training, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineering), Ltd.
Brooklands Aviation, Ltd.
Derby Aviation, Ltd.
Eagle Aircraft Services, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Handley Page, Ltd.
Hants and Sussex Aviation, Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Miles, Ltd., F. G.
Rollason Aircraft and Engines, Ltd.
Samlesbury Engineering, Ltd.
Skyways, Ltd.
Warden Aviation and Engineering Co.

REPAIR, ENGINE

Aviation Traders (Engineering), Ltd.
Brooklands Aviation, Ltd.
de Havilland Engine Co., Ltd., The
Eagle Aircraft Services, Ltd.
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Hants and Sussex Aviation, Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Rollason Aircraft and Engines, Ltd.
Samlesbury Engineering, Ltd.
Warden Aviation and Engineering Co.

RESISTORS

Copeland and Jenkins, Ltd.
Fawcett, Preston and Co., Ltd.
General Electric Co., Ltd., The

Continued overleaf

ANCILLARY INDUSTRY 1958...

Muirhead and Co., Ltd.
Newton and Co., H. T.
Plessey Co., Ltd., The
Salford Electrical Instruments, Ltd.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Technograph Electronic Products, Ltd.
Technograph Printed Circuits, Ltd.
Turner Electrical Instruments, Ltd., Ernest

RHEOSTATS

Ferranti (Meters), Ltd., Denis
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.

RIVETS—see A.G.S. Parts

RIVETING EQUIPMENT

Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Aviation Developments, Ltd.
Bardolph and Partners, Ltd., J. F.
Brown Brothers (Aircraft), Ltd.
Newton and Co., H. T.
Tucker Eyelet Co., Ltd., Geo.

ROLLERS, CONVEYOR

Aerocontacts (Ground Equipment), Ltd.
Bretts Precision Engineering Co., Ltd.
Coin Insulation, Ltd.
Hines (Engineers), Ltd., Edward

ROPES

British Ropes, Ltd.

RUBBER, EXPANDED

Baines, Ltd., C. O. H.
Bell's Asbestos and Engineering, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Fireproof Tanks, Ltd.
Kautex, Ltd.
Newton and Co., H. T.
Precision Rubbers, Ltd.
Spencer Moulton and Co., Ltd., George

RUBBER, GENERAL AND MECHANICAL
(including synthetic rubbers and bonded components)

Baines, Ltd., C. O. H.
Bell's Asbestos and Engineering, Ltd.
Boorn and Co., Ltd., Thomas
Dowty Seals, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Esso Petroleum Co., Ltd.
Fireproof Tanks, Ltd.
Godden (Moulding), Ltd., M. H.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd.
Hall and Hall, Ltd.
Kautex, Ltd.
Long and Hambly, Ltd.
Precision Rubbers, Ltd.
St. Helens Cable and Rubber Co., Ltd.
Silentbloc, Ltd.
Sky-Lines Aircraft Components, Ltd.
Spencer Moulton and Co., Ltd., George
Super Oil Seals and Gaskets, Ltd.
Trist and Co., Ltd., Ronald
Uhlhorn Bros., Ltd.

RUST REMOVERS AND INHIBITORS
(see also Corrosion Inhibitors, Protective Processes, etc.)

Aerocontacts (Ground Equipment), Ltd.
Albright and Wilson (Mfg.), Ltd.
Brent Chemical Products, Ltd.
Docker Brothers
Esso Petroleum Co., Ltd.
Hall and Sons (Bristol and London), Ltd., John
Magnus Chemical Co., Ltd.
Modern Industrial Finishes, Ltd.
Pyrene Co., Ltd., The
Shell-Mex and B.P., Ltd.
Stuart (London), Ltd., Robert
Vaughan and Co., Ltd., Edgar
Walterisation Co., Ltd., The

SAFETY EQUIPMENT—see Life-saving Equipment

SALES, AIRCRAFT

Aerocontacts (Aircraft Distributors), Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Bristol Aircraft, Ltd.
Derby Aviation, Ltd.
Eagle Aircraft Services, Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
Hants and Sussex Aviation, Ltd.
Helicopter Sales, Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Miles, Ltd., F. G.
Newton and Co., H. T.
Rollason Aircraft and Engines, Ltd.
Scottish Aviation, Ltd.
Shackleton, Ltd., W. S.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.
Warden Aviation and Engineering Co.

SALES, ENGINE

Aerocontacts (Aircraft Distributors), Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Armstrong Siddeley Motors, Ltd.
Aviation Traders, Ltd.
Bristol Aircraft, Ltd.
Centrax, Ltd.
Derby Aviation, Ltd.
Eagle Aircraft Services, Ltd.
Hants and Sussex Aviation, Ltd.
Newton and Co., H. T.
Rollason Aircraft and Engines, Ltd.
Shackleton, Ltd., W. S.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.
Warden Aviation and Engineering Co.

SALES, HELICOPTER

Aerocontacts (Aircraft Distributors), Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Bristol Aircraft, Ltd.
Fairey Aviation Co., Ltd., The
Helicopter Sales, Ltd.
Hordern-Richmond (Sales), Ltd.
Newton and Co., H. T.
Shackleton, Ltd., W. S.
Sky-Lines Aircraft Components, Ltd.
Westland Aircraft, Ltd.

SALVAGE EQUIPMENT, AIRCRAFT

Aerocontacts (Ground Equipment), Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Newton and Co., H. T.

SALVAGE OF AIRCRAFT

Aerocontacts (Ground Equipment), Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Hants and Sussex Aviation, Ltd.
Newton and Co., H. T.

SCRAP, COLLECTION AND DISPOSAL OF

Aviation Traders (Engineering), Ltd.
Coley and Sons (Hounslow), Ltd., R. J.
Newton and Co., H. T.

SCREWS—see A.G.S. Parts

SEALANTS

B. B. Chemical Co., Ltd.
Fireproof Tanks, Ltd.
Kane, Ltd., Douglas
Kenilworth Manufacturing Co., Ltd., The
Midland Silicones, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Trist and Co., Ltd., Ronald

SEALANTS, RUNWAY JOINTING

B. B. Chemical Co., Ltd.

SEALS, MECHANICAL

Brown Brothers (Aircraft), Ltd.
Coin Insulation, Ltd.
Dowty Seals, Ltd.
Electro-Hydraulics, Ltd.
Flexibox, Ltd.
Hellermann, Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Precision Rubbers, Ltd.
Spencer Moulton and Co., Ltd., George
Super Oil Seals and Gaskets, Ltd.
Trist and Co., Ltd., Ronald
Vaughan and Co., Ltd., Edgar
Wellworthy, Ltd.
Wills Pressure Filled Joint Ring, Ltd.

SEATS, AIRCRAFT

Aerocontacts (Aircraft Distributors), Ltd.
Aeroplastics, Ltd.
Aviation Traders (Engineering), Ltd.
Baynes Aircraft Interiors, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Field Aircraft Services, Ltd.
Flight Equipment and Engineering, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Irwin and Partners, Ltd., E. G.
King Aircraft Corporation.
Lancefield Aircraft Components, Ltd.
Latex Upholstery, Ltd.
Microcell, Ltd.
Newton and Co., H. T.
Rumbold and Co., Ltd., L. A.
Samlesbury Engineering, Ltd.
Short Brothers and Harland, Ltd.
Transport Seating, Ltd.
Western Mfg. (Reading), Ltd.

SEATS, EJECTION

Folland Aircraft, Ltd.
Martin-Baker Aircraft Co., Ltd.

SEMICONDUCTORS

British Thomson-Houston Co., Ltd., The
Eagle Aircraft Services, Ltd.
English Electric Co., Ltd., The
Ferranti, Ltd.
General Electric Co., Ltd., The
Honeywell Controls, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Mining and Chemical Products, Ltd.
Mullard, Ltd.
Semiconductors, Ltd.
Standard Telephones and Cables, Ltd.
Texas Instruments, Ltd.
Westinghouse Brake and Signal Co., Ltd.
Whittemore (Aeradio), Ltd., A. J.

SERVICING, AIRFRAME

Air Service Training, Ltd.
Airwork, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
British Aviation Services (Engineering), Ltd.
Brooklands Aviation, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Hants and Sussex Aviation, Ltd.
Leytonstone Jig and Tool Co., Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Miles, Ltd., F. G.
Rollason Aircraft and Engines, Ltd.
Scottish Aviation, Ltd.
Skyways, Ltd.
Warden Aviation and Engineering Co.

SERVICING, ELECTRONIC

Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
Bradley, Ltd., G. and E.
British Aviation Services (Engineering), Ltd.
Cossor Instruments, Ltd.
Eagle Aircraft Services, Ltd.
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Leytonstone Jig and Tool Co., Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Plessey Co., Ltd., The
Skyways, Ltd.
Soundrite, Ltd.

SERVICING, ENGINE

Air Engine Services (U.S.-U.K.), Ltd.
Airwork, Ltd.
Armstrong Siddeley Motors, Ltd.
Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
BP Trading, Ltd.
British Aviation Services (Engineering), Ltd.
Brooklands Aviation, Ltd.
de Havilland Engine Co., Ltd., The
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Hants and Sussex Aviation, Ltd.
Leytonstone Jig and Tool Co., Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Scottish Aviation, Ltd.
Skyways, Ltd.
Warden Aviation and Engineering Co.

SERVICING, INSTRUMENT

Air Engine Services (U.S.-U.K.), Ltd.
Airwork, Ltd.
Aviation Traders (Engineering), Ltd.
Avimo, Ltd.
B.K.S. Engineering, Ltd.
British Aviation Services (Engineering), Ltd.
Eagle Aircraft Services, Ltd.
Field Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Kelvin and Hughes (Aviation), Ltd.
Leytonstone Jig and Tool Co., Ltd.
McAlpine and Sons, Ltd. (Aviation Division), Sir Robert
Measuring Instruments (Pullin), Ltd.
Miles, Ltd., F. G.
Newton and Co., H. T.
Pandect Instrument Laboratories, Ltd.
Skyways, Ltd.
Smiths Aircraft Instruments
Ultra Electric, Ltd.
Walter, A. J.

SERVO MECHANISMS

Air Engine Services (U.S.-U.K.), Ltd.
Andec, Ltd.
Boulton Paul Aircraft, Ltd.
British Messier, Ltd.
Electro-Hydraulics, Ltd.
Elliott Brothers (London), Ltd.
Fairey Aviation Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Flight Refuelling, Ltd.
Gloster Technical Developments
Graseby Instruments, Ltd.
Hobson, Ltd., H. M.
Hymatic Engineering Co., Ltd., The
Ketay, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Miles, Ltd., F. G.
Muirhead and Co., Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Pullin and Co., Ltd., R. H.
Redwing, Ltd.
Short Brothers and Harland, Ltd.
Siemens Edison Swan, Ltd.
Scottish Distributors, Ltd.
Smiths Aircraft Instruments
Sperry Gyroscope Co., Ltd.
Ultra Electric, Ltd.
Vactric (Control Equipment), Ltd.
Vernons Industries, Ltd.
Walter, A. J.
Wilmot Breeden, Ltd.

SHEET AND PLATE, LIGHT ALLOY

Aluminium Corporation, Ltd.
Booth and Co., Ltd., James
Brockhouse and Co., Ltd., J.
Eagle Aircraft Services, Ltd.
Flight Refuelling, Ltd.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Heston Aircraft and Associated Engineers, Ltd.
High Duty Alloys, Ltd.
Imperial Chemical Industries, Ltd.
Northern Aluminium Co., Ltd.
Rapp, Ltd., Leo
Reynolds T. I. Aluminium, Ltd.
Rollet and Co., Ltd., H.
Western Mfg. (Reading), Ltd.

SHEET METAL WORK—see Fabrications

SHIMS

Attewell and Sons, Ltd., B.
Coopers Mechanical Joints, Ltd.
Eagle Aircraft Services, Ltd.
Macready's Metal Co., Ltd.

SHOCK ABSORBERS—see Mountings, Shock-absorbing

SHUTTERS

Hercules Engineering Co., Ltd., The

SILENCERS

Cementation (Muffelite), Ltd.
Cullum and Co., Ltd., Horace W.
Detuners, Ltd.
Godfrey and Partners, Ltd., Sir George
Henshall and Sons (Addlestone), Ltd.
Hercules Engineering Co., Ltd., The
Morfax, Ltd.
Vokes, Ltd.

ADDRESSES OF COMPANIES: pages 374-380

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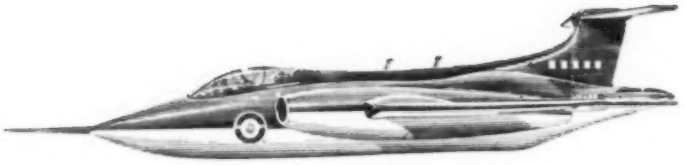
At 'thin air' altitudes



in vertical take-off

cooling problems level out with

The Blackburn NA 39 and the Fairey Rotodyne —two of the year's most advanced aircraft— have been fitted with special cooling equipment individually designed by Plannair.

Both of these aircraft presented a cooling problem of the most complex kind. Both have been provided with 'blowing' which completely satisfies their requirements.

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Enough air in the right place

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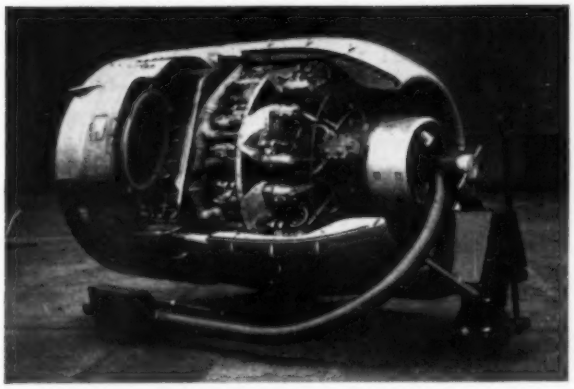

Aerocontacts' "Scoba engine porter," Mk 2, with Wright R.3350.

ANCILLARY INDUSTRY 1958...

SILICONE PRODUCTS
Aeroplastics, Ltd.
Bell's Asbestos and Engineering, Ltd.
Coin Insulation, Ltd.
Docker Brothers
Dowty Seals, Ltd.
Fireproof Tanks, Ltd.
Hall and Hall, Ltd.
Kautex, Ltd.
Long and Hambly, Ltd.
Midland Silicones, Ltd.
Modern Industrial Finishes, Ltd.
Siemens Edison Swan, Ltd.
Spencer Moulton and Co., Ltd., George

SIMULATORS—see Training Equipment

SLIDE-RULES
Newton and Co., H. T.
Scottish Distributors, Ltd.

SLIDES, DRAWER, ETC.
Newton and Co., H. T.

SOLDERING EQUIPMENT AND SOLDER
Adcola Products, Ltd.
Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
General Electric Co., Ltd., The
Henley's Telegraph Works, Co., Ltd., The
Light Soldering Developments, Ltd.
Newton and Co., H. T.
Sheffield Smelting Co., Ltd., The
Standard Telephones and Cables, Ltd.
Tiltman Langley, Ltd.

SOLENOIDS
Aerocontacts (Sales), Ltd.
British Messier, Ltd.
British Thomson-Houston Co., Ltd., The
Dowty Nucleonics, Ltd.
Eastern Aero Electrical Services, Ltd.
Electro-Hydraulics, Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Scottish Distributors, Ltd.
Specto, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Western Manufacturing (Reading), Ltd.

SOUNDPROOFING MATERIALS
Baxter, Woodhouse and Taylor, Ltd.
Baynes Aircraft Interiors, Ltd.
Bell's Asbestos and Engineering, Ltd.
Cullum and Co., Ltd., Horace W.
Jablo Plastics Industries, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Newalls Insulation Co., Ltd.
Rumbold and Co., Ltd., L. A.
Soundrite, Ltd.

SPARES, SUPPLY OF
Aero Controls, Ltd.
Aerocontacts (Sales), Ltd.
Aeronautical Trades and Manufacturing Co., Ltd.
Air Engine Services (U.S.-U.K.), Ltd.
Airline Air Spares, Ltd.
Aviation Traders, Ltd.
B.S.T. Aeronautical Co., Ltd.
British Thomson-Houston Co., Ltd., The
Eagle Aircraft Services, Ltd.
Eastern Aero Electrical Services, Ltd.
Fairey Aviation Co., Ltd., The
Flight Refuelling, Ltd.
Hants and Sussex Aviation, Ltd.
Irish Air Charter, Ltd.
Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Phillips and White, Ltd.
Scottish Distributors, Ltd.
Sky-Lines Aircraft Components, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Warden Aviation and Engineering Co.
Woodside Die Sinking Co., Ltd.

SPRAYING EQUIPMENT (for paint, etc.)
Aerocontacts (Ground Equipment), Ltd.
Lacy-Hulbert and Co., Ltd.

SPRINGS
Cross Manufacturing Co. (1938), Ltd.
Ferranti (Meters), Ltd., Denis
Fox and Co., Ltd., Samuel
Powis and Sons Ltd., David
Ratcliffe (Rochdale), Ltd., F. S.
Riley, Ltd., Robert
Salter and Co., Ltd., Geo.
Spring Washers, Ltd.
Terry and Sons, Ltd., Herbert

STABILIZERS, AUTOMATIC
Elliott Brothers (London), Ltd.
Fairey Aviation Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Honeywell Controls, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Short Brothers and Harland, Ltd.
Smiths Aircraft Instruments
Sperry Gyroscope Co., Ltd.

STAGINGS, PLATFORMS, ETC., ASSEMBLY AND MAINTENANCE
Aero Controls, Ltd
Aerocontacts (Ground Equipment), Ltd.
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Laycock Engineering, Ltd.
Mercury Airfield Equipment, Ltd.
Morfax, Ltd.

STANDS, ENGINE
Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
Eagle Aircraft Services, Ltd.
Hercules Engineering Co., Ltd., The
M. L. Aviation Co., Ltd.
Mercury Airfield Equipment, Ltd.
Morfax, Ltd.
Pipework and Engineering (Bristol), Ltd.
Reynolds (Packaging), Ltd.
Ross, Ltd., S. Grahame.
Rover Gas Turbines, Ltd.
Scotney, Ltd., Tom M.
Walter, A. J.
Wellwinch Engineering, Ltd.

STEELS, AIRCRAFT (see also Alloys, ferrous, etc.)
Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Brown Bayley Steels, Ltd.
Brown Brothers (Aircraft), Ltd.
Carlisle and Co., Ltd., C. G.
English Steel Rolling Mills Corporation, Ltd.
Firth and John Brown, Ltd., Thos.
Firth-Vickers Stainless Steels, Ltd.
Flather, Ltd., W. T.
Fox and Co., Ltd., Samuel
Habershon and Sons, Ltd., J. J.
Hadfields, Ltd.
Jessop and Sons, Ltd., William
Low Moor Alloy Steelworks, Ltd.
Macready's Metal Co., Ltd.
Park Gate Iron and Steel Co., Ltd., The
Phosphor Bronze Co., Ltd.
Rapp, Ltd., Leo
Rollet and Co., Ltd., H.
Steel, Peech and Tozer
Talbot Stead Tube Co., Ltd.
Willan, Ltd., G. L.

STEELS, CORROSION RESISTING (see also Alloys, etc.)
Aircraft Materials, Ltd.
Brown Bayley Steels, Ltd.
Brown Brothers (Aircraft), Ltd.
Carlisle and Co., Ltd., C. G.
Firth-Vickers Stainless Steels, Ltd.
Fox and Co., Ltd., Samuel
Habershon and Sons, Ltd., J. J.
Hadfields, Ltd.
Jessop and Sons, Ltd., William
Low Moor Alloy Steelworks, Ltd.
Phosphor Bronze Co., Ltd.
Rapp, Ltd., Leo.
Rollet and Co., Ltd., H.
Talbot Stead Tube Co., Ltd.
Willan, Ltd., G. L.

STEELS, HEAT RESISTING (see also Alloys, etc.)
Brown Bayley Steels, Ltd.
Carlisle and Co., Ltd., C. G.
Firth-Vickers Stainless Steels, Ltd.
Flather, Ltd., W. T.
Fox and Co., Ltd., Samuel
Hadfields, Ltd.
Jessop and Sons, Ltd., William
Low Moor Alloy Steelworks, Ltd.
Phosphor Bronze Co., Ltd.
Rapp, Ltd., Leo
Talbot Stead Tube Co., Ltd.
Willan, Ltd., G. L.

STEPS, AIRCRAFT PASSENGER
Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd
Aero Maintenance Equipment, Ltd.
Aviation Traders (Engineering), Ltd.
B.K.S. Engineering, Ltd.
Clapham Park Motors, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Heston Aircraft and Associated Engineers, Ltd.
Mercury Airfield Equipment, Ltd.
Morfax, Ltd.
Ross, Ltd., S. Grahame

SURVEY, AIR
Derby Aviation, Ltd.
Fairey Air Surveys, Ltd.
Fairey Aviation Co., Ltd., The
Hunting Aerosurveys, Ltd.
Meridian Airmaps, Ltd.
Miles, Ltd., F. G.

SWEEPERS, RUNWAY
Aerocontacts (Ground Equipment), Ltd.
Brockhouse and Co., Ltd., J.
Lewin Road Sweepers, Ltd.
Sky-Lines Aircraft Components, Ltd.
Zwicky, Ltd.

SWITCHES, AUTOMATIC AND SPECIAL-PURPOSE
Airline Air Spares, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
British Thomson-Houston Co., Ltd., The
Burndept, Ltd.
Cathodeon, Ltd.
Dowty Nucleonics, Ltd.
Dunlop Rubber Co., Ltd.
Ferranti (Meters), Ltd., Denis
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Honeywell Controls, Ltd.
Irving Air Chute of Great Britain, Ltd.
Munro, Ltd., R. W.
Negretti and Zambra, Ltd.
Newton and Co., H. T.
Page Engineering Co.
Racal Engineering, Ltd.
Redwing, Ltd.
Rotax, Ltd.
Scottish Distributors, Ltd.
Teddington Aircraft Controls, Ltd.
Thermal Control Co., Ltd.
Thorn Electrical Industries, Ltd.
Venner, Ltd.
Western Manufacturing (Reading), Ltd.

SWITCHES, ELECTRICAL
Aerocontacts (Sales), Ltd.
Aeronautical Traders and Mfg. Co., Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
British Thomson-Houston Co., Ltd.
C.W.C. Equipment, Ltd.
"Diamond H" Switches, Ltd.
Dowty Nucleonics, Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
General Electric Co., Ltd., The
Graseby Instruments, Ltd.
Graviner Manufacturing Co., Ltd.
Honeywell Controls, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Sangamo Weston, Ltd.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Stone and Co. (Deptford), Ltd., J.
Thorn Electrical Industries, Ltd.
Venner, Ltd.
Western Manufacturing (Reading), Ltd.
Whittemore (Aeradio), Ltd., A. J.

TABLEWARE, AIRLINER
Aerogalley
Attewell and Sons, Ltd., B.
Baynes Aircraft Interiors, Ltd.
Thermo-Plastics, Ltd.
Vane and Co., A. H.

TANKS, DROP
Abbey Panel and Sheet Metal Co., Ltd., The
Air Service Training, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Bristol Aircraft, Ltd.

Continued overleaf

Bristol 100-gallon plastic drop tank is fitted to a Hunter.

ANCILLARY INDUSTRY 1958...

Burnley Aircraft Products, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Hickman, Ltd.
Lancefield Aircraft Components, Ltd.
Marston Excelsior, Ltd.
Miles, Ltd., F. G.
Potter, Ltd., Walter
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.

TANKS, FUEL AND OIL

Abbey Panel and Sheet Metal Co., Ltd., The
Aviation Traders (Engineering), Ltd.
Burnley Aircraft Products, Ltd.
Delaney Gallay, Ltd.
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Harvey and Co. (London), Ltd., G. A.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Hickman, Ltd.
Lancefield Aircraft Components, Ltd.
Marston Excelsior, Ltd.
Potter, Ltd., Walter
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.
Simmons and Hawker, Ltd.
Sky-Lines Aircraft Components, Ltd.
Vosper, Ltd.
Walter, A. J.
Wayne Tank and Pump Co., Ltd.
Westminster Airways Servicing, Ltd.

TAPES, ADHESIVE MASKING, ETC.

Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Brown Brothers (Aircraft), Ltd.
Cox and Son, Ltd., John
Docker Brothers
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
Henley's Wireless Telegraph Co., Ltd., W. T.
Minnesota Mining and Manufacturing Co., Ltd.
Newton and Co., H. T.
Rollet and Co., Ltd., H.
Telegraph Construction and Maintenance Co., Ltd. The
Vane and Co., A. H.

TARGETS—see Training Equipment

TEMPERATURE-SENSITIVE EQUIPMENT

Bryans Aeroquipment, Ltd.
Burndept, Ltd.
Gloster Aircraft Co., Ltd.
Graviner Manufacturing Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Negretti and Zambra, Ltd.
Newton and Co., H. T.
Research and Control Instruments, Ltd.
Salford Electrical Instruments, Ltd.
Sangamo Weston, Ltd.
Scottish Distributors, Ltd.
Stone and Co. (Deptford), Ltd., J.
Teddington Aircraft Controls, Ltd.
Walter, A. J.

TERMINALS

Aircraft Marine Products (Great Britain), Ltd.
Aircraft Materials, Ltd.
Belling and Lee, Ltd.
Brown Brothers (Aircraft), Ltd.
Cathodeon, Ltd.
Hellermann, Ltd.
Newton and Co., H. T.
Plessey Co., Ltd., The
Rist's Wires and Cables, Ltd.
Ross, Courtney and Co., Ltd.
Scottish Distributors, Ltd.
Stewart Aeronautical Supply Co., Ltd.

TEST EQUIPMENT, AERODYNAMIC

Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Dobbie McInnes, Ltd.
English Electric Co., Ltd., The
Field Aircraft Services, Ltd.
Hercules Engineering Co., Ltd., The
Miles, Ltd., F. G.
Newton and Co., H. T.
SFIM (Great Britain), Ltd.
Scottish Distributors, Ltd.
Western Mfg. (Reading), Ltd.

TEST EQUIPMENT, ELECTRICAL AND ELECTRONIC

Aerocontacts (Ground Equipment), Ltd.
Andec, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineering), Ltd.
Avo, Ltd.
Baxter, Woodhouse and Taylor, Ltd.
Bradley, Ltd., G. and E.
Boulton Paul Aircraft, Ltd.
British Thomson-Houston Co., Ltd.
Bryans Aeroquipment, Ltd.
Cossor Instruments, Ltd.
Dawe Instruments, Ltd.
Decca Radar, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Elliott Brothers (London), Ltd.
English Electric Co., Ltd., The
Ericsson Telephones, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
Field Aircraft Services, Ltd.
General Electric Co., Ltd., The
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Goodmans Industries, Ltd.
Hendrey Relays, Ltd.
Honeywell Controls, Ltd.
Integral, Ltd.
Ketay, Ltd.
Lancefield Aircraft Components, Ltd.
M. L. Aviation Co., Ltd.
Marconi Instruments, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Measuring Instruments (Pullin), Ltd.
Miles, Ltd., F. G.
Muirhead and Co., Ltd.
Murphy Radio, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Page Engineering Co.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Pye Telecommunications, Ltd.
Racal Engineering, Ltd.
Reid and Sigrist, Ltd.
Research and Control Instruments, Ltd.
Rollason Aerocessories, Ltd.
Rotax, Ltd.
SFIM (Great Britain), Ltd.
Salford Electrical Instruments, Ltd.
Sanders (Electronics), Ltd., W. H.
Sangamo Weston, Ltd.
Savage, Ltd., W. Bryan
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Solartron Electronic Group, Ltd., The
Soundrite, Ltd.
Southern Instruments, Ltd.
Specto, Ltd.
Standard Telephones and Cables, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Thermionic Products, Ltd.
Tiltman Langley, Ltd.
Turner Electrical Instruments, Ltd., Ernest
Ultra Electric, Ltd.
Venner, Ltd.
Vernons Industries, Ltd.
Wayne Kerr Laboratories, Ltd.
Western Manufacturing (Reading), Ltd.
Whittemore Aeradio), Ltd., A. J.
Z and I Aero Services, Ltd.

TEST EQUIPMENT, FUEL

Aerocontacts (Ground Equipment), Ltd.
BP Trading, Ltd.
Bryans Aeroquipment, Ltd.
English Electric Co., Ltd., The
Exactor, Ltd.
Field Aircraft Services, Ltd.
Firth Cleveland Instruments, Ltd.
Flight Refuelling, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Hobson, Ltd., H. M.
Integral, Ltd.
Lancefield Aircraft Components, Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Miles, Ltd., F. G.
Parman Aircraft Supplies, Ltd.
Saunders Valve Co., Ltd.
Simmons and Hawker, Ltd.
Stewart Aeronautical Co., Ltd.
Wayne Tank and Pump Co., Ltd.
Western Mfg. (Reading), Ltd.
Westminster Airways Servicing, Ltd.

TEST EQUIPMENT, HYDRAULIC

Aerocontacts (Ground Equipment), Ltd.
Aviation Traders (Engineering), Ltd.
British Messier, Ltd.
Dowty Equipment, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
Fawcett, Preston and Co., Ltd.
Ferranti (Meters), Ltd., Denis
Field Aircraft Services, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
H.M.L. (Engineering), Ltd.
Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Hobson, Ltd., H. M.
Hymatic Engineering Co., Ltd., The
I. V. Pressure Controllers, Ltd.
Integral, Ltd.
Lancefield Aircraft Components, Ltd.
Leytonstone Jig and Tool Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Mercury Airfield Equipment, Ltd.
Newton and Co., H. T.
Parman Aircraft Supplies, Ltd.
Rivers, Ltd., A. E.
Rollason Aerocessories, Ltd.
Southern Instruments, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Walter, A. J.
Wayne Tank and Pump Co., Ltd.
Western Manufacturing (Reading), Ltd.
Wilmot Breeden, Ltd.
Wynn and Co. (Aircraft), Ltd., E. D.

TEST EQUIPMENT, INSTRUMENT

Aerocontacts (Ground Equipment), Ltd.
British Thomson-Houston Co., Ltd., The
Bryans Aeroquipment, Ltd.
Elliott Brothers (London), Ltd.
E.M.O. Instrumentation, Ltd.
English Electric Co., Ltd., The
Ericsson Telephones, Ltd.
Fairey Air Surveys, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti, Ltd.
Field Aircraft Services, Ltd.
Firth Cleveland Instruments, Ltd.
General Electric Co., Ltd., The
Goodmans Industries, Ltd.
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Irving Air Chute of Great Britain, Ltd.
Ketay, Ltd.
Measuring Instruments (Pullin), Ltd.
Miles, Ltd., F. G.
Negretti and Zambra, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Page Engineering Co.
Pandect Instrument Laboratories, Ltd.
Parman Aircraft Supplies, Ltd.
Racal Engineering, Ltd.
Reid and Sigrist, Ltd.
Research and Control Instruments, Ltd.
Rollason Aerocessories, Ltd.
SFIM (Great Britain), Ltd.
Salford Electrical Instruments, Ltd.
Sanders (Electronics), Ltd., W. H.
Sangamo Weston, Ltd.
Savage, Ltd., W. Bryan
Scottish Distributors, Ltd.
Short and Mason, Ltd.
Siebe, Gorman and Co., Ltd.
Specto, Ltd.
Walter, A. J.
Western Mfg. (Reading), Ltd.

TEST EQUIPMENT, LABORATORY

Aerocontacts (Ground Equipment), Ltd.
Amal, Ltd.
Andec, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Bradley, Ltd., G. and E.
Bryans Aeroquipment, Ltd.
Cossor Instruments, Ltd.
Dawe Instruments, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Ericsson Telephones, Ltd.
Fairey Air Surveys, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Field Aircraft Services, Ltd.
Gloster Technical Developments
Goodmans Industries, Ltd.
Graseby Instruments, Ltd.
H.M.L. (Engineering), Ltd.
Hendrey Relays, Ltd.
Hercules Engineering Co., Ltd., The
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
Lec Refrigeration, Ltd.
Miles, Ltd., F. G.
Muirhead and Co., Ltd.
Murphy Radio, Ltd.
Newton and Co., H. T.
Portsmouth Aviation, Ltd.
Racal Engineering, Ltd.
Research and Control Instruments, Ltd.
Rollason Aerocessories, Ltd.
SFIM (Great Britain), Ltd.
Sanders (Electronics), Ltd., W. H.
Sangamo Weston, Ltd.
Savage, Ltd., W. Bryan
Scottish Distributors, Ltd.
Short and Mason, Ltd.
Siemens Edison Swan, Ltd.
Southern Instruments, Ltd.
Vernons Industries, Ltd.
Walter, A. J.
Wayne Kerr Laboratories, Ltd., The
Western Mfg. (Reading), Ltd.
Whittemore (Aeradio), Ltd., A. J.
Woodside Die Sinking Co., Ltd.

TEST EQUIPMENT, MECHANICAL

Aerocontacts (Ground Instruments), Ltd.
Aircraft Materials, Ltd.
Dobbie McInnes, Ltd.
E.M.I. Electronics, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Fairey Air Surveys, Ltd.
Fairey Aviation Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Field Aircraft Services, Ltd.
Goulder and Sons, Ltd., J.
Graseby Instruments, Ltd.
Hercules Engineering Co., Ltd., The
Hymatic Engineering Co., Ltd., The
Leytonstone Jig and Tool Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Newton and Co., H. T.
Optical Measuring Tools, Ltd.
Portsmouth Aviation, Ltd.
Research and Control Instruments, Ltd.
Rivers, Ltd., A. E.
Rover Gas Turbines, Ltd.
Southern Instruments, Ltd.
Teleflex Products, Ltd.,
Tiltman Langley, Ltd.
Walter A. J.
Wayne Kerr Laboratories, Ltd., The
Western Mfg. (Reading), Ltd.
Woodside Die Sinking Co., Ltd.
Wynn and Co., (Aircraft), Ltd., E. D.

TEST EQUIPMENT, METALLURGICAL

Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
English Electric Co., Ltd., The
Field Aircraft Services, Ltd.
Lec Refrigeration, Ltd.
Newton and Co., H. T.
Research and Control Instruments, Ltd.
Scottish Distributors, Ltd.
Tiltman Langley, Ltd.
Walter, A. J.

TEST EQUIPMENT, PNEUMATIC

Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Electro-Hydraulics, Ltd.
English Electric Co., Ltd., The
Fairey Aviation Co., Ltd., The
Field Aircraft Services, Ltd.
Gloster Aircraft Co., Ltd.
H.M.L. (Engineering), Ltd.
Headland Engineering Developments, Ltd.
High-Pressure Components, Ltd.
Hymatic Engineering Co., Ltd.
I. V. Pressure Controllers, Ltd.
Lacy-Hulbert and Co., Ltd.
Leytonstone Jig and Tool Co., Ltd.
Newton and Co., H. T.
Rollason Aerocessories, Ltd.
Walter, A. J.
Western Mfg. (Reading), Ltd.
Williams and James (Engineers), Ltd.

TEST-BED INSTALLATIONS, COMPLETE

Aerocontacts (Ground Equipment), Ltd.
Airwork, Ltd.
British Thomson-Houston Co., Ltd., The
Curran, Ltd., John
E.M.I. Electronics, Ltd.
Godfrey and Partners, Ltd., Sir George
Heenan and Froude, Ltd.
Hercules Enginering Co., Ltd., The
I. V. Pressure Controllers, Ltd.
Rover Gas Turbines, Ltd.

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Rawlplug Co., Ltd., The

TIMING DEVICES
British Thomson-Houston Co., Ltd., The
Ferranti (Meters), Ltd., Denis
Graseby Instruments, Ltd.
Hendrey Relays, Ltd.
Newmark, Ltd., Louis
Newton and Co., H. T.
Philips Electrical, Ltd.
Racal Engineering, Ltd.
Sanders (Electronics), Ltd., W. H.
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Solartron Electronic Group, Ltd., The
Specto, Ltd.
Teddington Aircraft Controls, Ltd.
Thermionic Products, Ltd.
Venner, Ltd.

TIMEKEEPING EQUIPMENT
Newmark, Ltd., Louis
Newton and Co., H. T.
Siemens Edison Swan, Ltd.

TITANIUM
Accles and Pollock, Ltd.
Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Imperial Chemical Industries, Ltd.
Jessop and Sons, Ltd., William

TOE STRAPS, CONTROL
Aero Controls, Ltd.

TOILET EQUIPMENT, AIRCRAFT
Aerocontacts (Ground Equipment), Ltd.
Air Service Training, Ltd.
Baynes Aircraft Interiors, Ltd.
Delaney Gallay, Ltd.
General Electric Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Lancefield Aircraft Components, Ltd.
Parnall and Co., Ltd., George
Ross, Ltd., S. Grahame
Saunders Valve Co., Ltd.
Suntex Safety Glass Industries, Ltd.

TOOLS, CUTTING
Aerocontacts (Ground Equipment), Ltd.
Brockhouse and Co., Ltd., J.
English Steel Tool Corporation, Ltd.
Goulder and Sons, Ltd., J.
Hellermann, Ltd.
Jessop and Sons, Ltd., William
Scintilla, Ltd.
Scottish Distributors, Ltd.

TOOLS, ENGINEERS' HAND
Aerocontacts (Ground Equipment), Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Brockhouse and Co., Ltd., J.
English Steel Tool Corporation, Ltd.
Headland Engineering Developments, Ltd.
Jenks Brothers, Ltd.
Leytonstone Jig and Tool Co., Ltd.
M.H.H. Engineering Co., Ltd.
Mollart Engineering Co., Ltd., The
Newton and Co., H. T.
Scintilla, Ltd.
Scottish Distributors, Ltd.
Simmonds Aerocessories, Ltd.

TOOLS, FORM
Abbey Panel and Sheet Metal Co., Ltd., The
Aerocontacts (Ground Equipment), Ltd.
Brockhouse and Co., Ltd., J.
Centrax, Ltd.
English Steel Tool Corporation, Ltd.
Gloster Engineering (Cheltenham), Ltd.
Goulder and Sons, Ltd., J.
Henshall and Sons (Addlestone), Ltd., W.
Jessop and Sons, Ltd., William
Jig Design and Engineering Co., Ltd.
London Production Tools, Ltd.
Miles, Ltd., F. G.
Newmark, Ltd., Louis
Samlesbury Engineering, Ltd.
Walker (A. D.), Ltd., James

TOOLS, MACHINE
Aerocontacts (Ground Equipment), Ltd.
Brockhouse and Co., Ltd., J.
Brown Industries, Ltd. (Machine Tool Division), David
Eagle Aircraft Services, Ltd.
Fairey Aviation Co., Ltd., The
Leytonstone Jig and Tool Co., Ltd.
Mollart Engineering Co., Ltd., The

TOOLS, PORTABLE POWER
Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Desoutter Brothers, Ltd.
Morris, Ltd., B. O.
Scintilla, Ltd.

TOOLS, PRESS
Abbey Panel and Sheet Metal Co., Ltd., The
Aerocontacts (Ground Equipment), Ltd.
Aerolex, Ltd.
Attewell and Sons, Ltd., B.
Cornercroft, Ltd.
Enfield Tool Manufacturing Co., Ltd., The
Fairey Aviation Co., Ltd., The
Gloster Engineering (Cheltenham), Ltd.
Hadfields, Ltd.
Henderson Safety Tank Co., Ltd., The
Henshall and Sons (Addlestone), Ltd., W.
Hordern-Richmond (Sales), Ltd.
Jig Design and Engineering Co., Ltd.
Keim Engineering, Ltd.
Leytonstone Jig and Tool Co., Ltd.
London Production Tools, Ltd.
Miles, Ltd., F. G.
Royston Industries, Ltd.
Samlesbury Engineering, Ltd.
Spa Guilds, Ltd.
Walker (A. D.), Ltd., James

TOOLS, RIVETING
Aerocontacts (Ground Equipment), Ltd.
Aircraft Materials, Ltd.
Aviation Developments, Ltd.
Bardolph and Partners, Ltd., J. F.
Brown Brothers (Aircraft), Ltd.
Tucker Eyelet Co., Ltd., Geo.

TOOLS, SPECIAL PURPOSE
Aerocontacts (Ground Equipment), Ltd.
Aircraft Marine Products (Great Britain), Ltd.
Aircraft Materials, Ltd.
Armstrong Whitworth Aircraft, Ltd., Sir W. G.
Aviation Traders (Engineernig), Ltd.
Bell Precision Engineering Co., Ltd.
Brockhouse and Co., Ltd., J.
Centrax, Ltd.
Enfield Tool Mfg. Co., Ltd., The
Fairey Aviation Co., Ltd., The
Goulder and Sons, Ltd., J.
Hadfields, Ltd.
Headland Engineering Developments, Ltd.
Hellermann, Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Jameson, Ltd., J. L.
Jenks Brothers, Ltd.
Jig Design and Engineering Co., Ltd.
Kane, Ltd., Douglas
King Aircraft Corporation
Kingston Instrument Co., Ltd.
Leytonstone Jig and Tool Co., Ltd.
London Production Tools, Ltd.
Miles, Ltd., F. G.
Mollart Engineering Co., Ltd., The
Newmark, Ltd., Louis
North West Machine Design Co., Ltd.
Rawlplug Co., Ltd., The
Rotax, Ltd.
Spa Guilds, Ltd.
Telegraph Construction and Maintenance Co., Ltd., The
Walker (A. D.), Ltd., James
Woodside Die Sinking Co., Ltd.

TRACTORS, AIRCRAFT—see also Handling equipment
Aerocontacts (Ground Equipment), Ltd.
Brown Construction Equipment, Ltd., David
Douglas Equipment, Ltd.
Lansing Bagnall, Ltd.
Mercury Truck and Tractor Co., Ltd., The
Petbow, Ltd.

TRAINING, AIRCREW
Air Service Training, Ltd.
Brooklands Aviation, Ltd.
Derby Aviation, Ltd.
General Air Training, Ltd.
Hunting Clan Air Transport, Ltd.
London School of Air Navigation, The
M. L. Aviation Co., Ltd.
Redifon, Ltd.

TRAINING, TECHNICAL
Air Service Training, Ltd.
English Electric Co., Ltd., The
Field Aircraft Services, Ltd.
International Aeradio, Ltd.
M. L. Aviation Co., Ltd.
Sanders (Electronics), Ltd., W. H.
Solartron Electronic Group, Ltd., The

TRAINING EQUIPMENT, AIRCREW
Air Trainers Link, Ltd.
Dobbie McInnes, Ltd.
Lewis, Ltd., D.
M. L. Aviation Co., Ltd.
McMichael Radio, Ltd.
Martin-Baker Aircraft Co.
Miles, Ltd., F. G.
Redifon, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Ultra Electric, Ltd.

TRAINING EQUIPMENT, ARMAMENT
Dobbie McInnes, Ltd.
Elliot Equipment, Ltd.
M. L. Aviation Co., Ltd.
Redifon, Ltd.
Ultra Electric, Ltd.

TRANSFERS, LETTERING, ETC.
Kaylee Transfers, Ltd.

TRANSFORMERS
Andec, Ltd.
Ardente Acoustic Laboratories, Ltd.
British Thomson-Houston Co., Ltd.
Eagle Aircraft Services, Ltd.
English Electric Co., Ltd.
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Murphy Radio, Ltd.
Plessey Co., Ltd., The
Rotax, Ltd.
Scottish Distributors, Ltd.
Soundrite, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Turner Electrical Instruments, Ltd., Ernest
Vernons Industries, Ltd.
Western Mfg. (Reading), Ltd.
Whittemore (Aeradio), Ltd., A. J.

TRANSPORT OF AIRCRAFT AND EQUIPMENT —see Packaging and Dispatch

TROLLEYS
Aerocontacts (Ground Equpment), Ltd.
Aero Controls, Ltd.
Aero Maintenance Equipment, Ltd.
Autoset (Production), Ltd.
Aviation Traders (Engineering), Ltd.
Clapham Park Motors, Ltd.
Eccles (Birmingham), Ltd.
Henshall and Sons (Addlestone), Ltd., W.
Hercules Engineering Co., Ltd., The
Lansing Bagnall, Ltd.
Mercury Truck and Tractor Co., Ltd.
Parman Aircraft Supplies, Ltd.
Siebe, Gorman and Co., Ltd.
Vernons Industries, Ltd.
Westminster Airways Servicing, Ltd.

TRUCKS (Fork-lift, etc.)
Aerocontacts (Ground Equipment), Ltd.
Aviation Traders (Engineering), Ltd.
Douglas Equipment, Ltd.
Eccles (Birmingham), Ltd.
Electro-Hydraulics, Ltd.
Heston Aircraft and Associated Engineers, Ltd.
Lansing Bagnall, Ltd.
Mercury Truck and Tractor Co., Ltd., The
Power Jacks, Ltd.

TUBING, AIRCRAFT, STEEL
Accles and Pollock, Ltd.
Aerocontacts (Sales), Ltd.
Aircraft Materials, Ltd.
Chesterfield Tube Co., Ltd., The
Eagle Aircraft Services, Ltd.
Rapp, Ltd., Leo
Reynolds Tube Co., Ltd.
Rollet and Co., Ltd., H.
Sanders (Electronics), Ltd., W. H
Talbot Stead Tube Co., Ltd.
Tubes, Ltd.

TUBING, AIRCRAFT, STAINLESS
Accles and Pollock, Ltd.
Chesterfield Tube Co., Ltd., The
Eagle Aircraft Services, Ltd.
Rapp, Ltd., Leo
Rollet and Co., Ltd., H.
Talbot Stead Tube Co., Ltd.

TUBING, FLEXIBLE—see Hose, Flexible

TUBING, SEAMLESS
Accles and Pollock, Ltd.
Booth and Co., Ltd., James
Chesterfield Tube Co., Ltd., The
Eagle Aircraft Services, Ltd.
Northern Aluminium Co., Ltd.
Plessey Co., Ltd., The
Rapp, Ltd., Leo
Reynolds T. I. Aluminium, Ltd.
Reynolds Tube Co., Ltd.
Rollet and Co., Ltd., H.
Serck Radiators, Ltd.
Southern Forge, Ltd.
Suntex Safety Glass Industries, Ltd.
Talbot Stead Tube Co., Ltd.
Tubes, Ltd.

TUBING, OTHER THAN ABOVE
Accles and Pollock, Ltd.
Aeroplastics, Ltd.
Aircraft Materials, Ltd.
Birkett, Billington and Newton, Ltd.
Booth and Co., Ltd., James
British Aluminium Co., Ltd., The
Hercules Engineering Co., Ltd., The
Hickman, Ltd.
Imperial Chemical Industries, Ltd.
Kautex, Ltd.
Miles, Ltd., F. G.
Rollet and Co., Ltd., H.
Talbot Stead Tube Co., Ltd.
Tecalemit, Ltd.
Telegraph Construction and Maintenance Co., Ltd., The
Thermo-Plastics, Ltd.
Trist and Co., Ltd., Ronald

TUBULAR COMPONENTS
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Hercules Engineering Co., Ltd., The
High-Pressure Components, Ltd.
Lancefield Aircraft Components, Ltd.
Miles, Ltd., F. G.
Pipework and Engineering (Bristol), Ltd.
Reynolds Tube Co., Ltd.
Ross, Ltd., S. Grahame
Rumbold and Co., Ltd., L. A.
Talbot Stead Tube Co., Ltd.
Tubes, Ltd.
Wilmot Breeden, Ltd.

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Tungum Co., Ltd., The

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Autoset (Production), Ltd.
Aviation Traders (Engineering), Ltd.
Dunlop Rubber Co., Ltd.
Eagle Aircraft Services, Ltd.
Firestone Tyre and Rubber Co., Ltd.
Goodyear Tyre and Rubber Co. (Great Britain), Ltd.
Parman Aircraft Supplies, Ltd.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.

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UNIFORM—see Clothing

UPHOLSTERY MATERIALS —see also Leather
Aerocontacts (Aircraft Distributors), Ltd.
Cox and Son, Ltd., John
Eagle Aircraft Services, Ltd.
Fothergill and Harvey (Sales), Ltd.
Hairlok Co., Ltd., The
Imperial Chemical Industries, Ltd. (Leathercloth Division)
Jablo Plastics Industries, Ltd.
Lancefield Aircraft Components, Ltd.
Latex Upholstery, Ltd.
Rumbold and Co., Ltd., L. A.

VALVES, ELECTRONIC
Aerocontacts (Sales), Ltd.
British Brown-Boveri, Ltd.
British Thomson-Houston Co., Ltd., The
Cossor Instruments, Ltd.
E.M.I. Electronics, Ltd.
English Electric Co., Ltd., The
Ericsson Telephones, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd., The
Marconi's Wireless Telegraph Co., Ltd.

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Mullard, Ltd.
Newton and Co., H. T.
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Savage, Ltd., W. Bryan
Siemens Edison Swan, Ltd.
Standard Telephones and Cables, Ltd.
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Whittemore (Aeradio), Ltd., A. J.

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Hadfields, Ltd.
Hughes-Johnson Stampings, Ltd., The
Newton and Co., H. T.
Sky-Lines Aircraft Components, Ltd.
Walter, A. J.

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Amal, Ltd.
B.R.D. Co., Ltd.
Birkett, Billington and Newton, Ltd.
British Ermeto Corporation, Ltd.
British Messier, Ltd.
British Oxygen Aro Equipment, Ltd.
Brown Brothers (Aircraft), Ltd.
Dowty Equipment, Ltd.
Dowty Nucleonics, Ltd.
Dunlop Rubber Co., Ltd.
Electro-Hydraulics, Ltd.
Fairey Aviation Co., Ltd., The
Fawcett, Preston and Co., Ltd.
Flight Refuelling, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
I. V. Pressure Controllers, Ltd.
Integral, Ltd.
Lockheed Hydraulic Brake Co., Ltd.
Lucas (Gas Turbine Equipment), Ltd., Joseph
Miles, Ltd., F. G.
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Plessey Co., Ltd., The
Rollason Aerocessories, Ltd.
Ross, Ltd., S. Grahame
Saunders Valve Co., Ltd.
SPE Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Talbot Stead Tube Co., Ltd.
Teddington Aircraft Controls, Ltd.
Western Mfg. (Reading), Ltd.
Williams and James (Engineers), Ltd.
Wilmot Breeden, Ltd.

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Amal, Ltd.
B.R.D. Co., Ltd.
Birkett, Billington and Newton, Ltd.
British Ermeto Corporation, Ltd.
British Messier, Ltd.
British Oxygen Aro Equipment, Ltd.
Brown Brothers (Aircraft), Ltd.
Bryans Aeroquipment, Ltd.
Dowty Equipment, Ltd.
Dowty Nucleonics, Ltd.
Dunlop Rubber Co., Ltd.
Flight Refuelling, Ltd.
Gloster Aircraft Co., Ltd.
Gloster Technical Developments
Godfrey and Partners, Sir George
Graseby Instruments, Ltd.
Headland Engineering Developments, Ltd.
High-Pressure Components, Ltd.
Honeywell Controls, Ltd.
Hymatic Engineering Co., Ltd., The
I.V. Pressure Controllers, Ltd.
Kidde Co., Ltd., The Walter
King Aircraft Corporation
Newton and Co., H. T.
Palmer Aero Products, Ltd.
Rollason Aerocessories, Ltd.
Rotax, Ltd.
Saunders Valve Co., Ltd.
Siebe, Gorman and Co., Ltd.
SPE Co., Ltd.
Stewart Aeronautical Supply Co., Ltd.
Teddington Aircraft Controls, Ltd.
Western Mfg. (Reading), Ltd.
Williams and James (Engineers), Ltd.

VEHICLES
(other than categories specifically named)

Aerocontacts (Ground Equipment), Ltd.
Hunting Aircraft, Ltd.
Mercury Truck and Tractor Co., Ltd., The
Samlesbury Engineering, Ltd.
Short Brothers and Harland, Ltd.

VIBRATION GENERATORS

E.M.I. Electronics, Ltd.
General Electric Co., Ltd., The
Goodmans Industries, Ltd.
Fairey Air Surveys, Ltd.
Muirhead and Co., Ltd.
Newton and Co., H. T.
Savage, Ltd., W. Bryan

VOLTAGE REGULATORS

Aerocontacts (Sales), Ltd.
Airline Air Spares, Ltd.
Aviation Traders (Engineering), Ltd.
Avimo, Ltd.
British Brown-Boveri, Ltd.
British Thomson-Houston Co., Ltd., The
Eastern Aero Electrical Services, Ltd.
English Electric Co., Ltd.
Ferranti, Ltd.
Ferranti (Meters), Ltd., Denis
General Electric Co., Ltd., The
Murphy Radio, H. T.
Newton and Co., H. T.
Newton Brothers (Derby), Ltd.
Parman Aircraft Supplies, Ltd.
Phillips and White, Ltd.
Plessey Co., Ltd., The
Research and Control Instruments, Ltd.
Rotax, Ltd.
Sanders (Electronics), Ltd., W. H.
Scottish Distributors, Ltd.
Siemens Edison Swan, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Stone and Co. (Deptford), Ltd.
Walter, A. J.
Whittemore (Aeradio), Ltd., A. J.

WASHERS—see A.G.S. Parts

WATCHES

Newmark, Ltd., Louis
Newton and Co., H. T.
Stewart Aeronautical Supply Co., Ltd.

WAVEGUIDES

Astralux, Ltd.
British Thomson-Houston Co., Ltd., The
Cossor Radar and Electronics, Ltd.
Decca Radar, Ltd.
E.M.I. Electronics, Ltd.
English Electric Co., Ltd., The
General Electric Co., Ltd., The
Kent Alloys, Ltd.
Lancefield Aircraft Components, Ltd.
Marston Excelsior, Ltd.
Newton and Co., H. T.
Research and Control Developments, Ltd.
Rollet and Co., Ltd., H.
Sanders (Electronics), Ltd., W. H.
Siemens Edison Swan, Ltd.
Stone and Co. (Charlton), Ltd., J.
Whittemore (Aeradio), Ltd., A. J.

WEIGHING EQUIPMENT

Aerocontacts (Ground Equipment), Ltd.
British Aviation Services (Engineering), Ltd.
Elliott Brothers (London), Ltd.
Newton and Co., H. T.
Parsons and Co., Ltd., S.
Research and Control Instruments, Ltd.
Salter and Co., Ltd., Geo.
Skyhi, Ltd.
Western Mfg. (Reading), Ltd.

WEIGHING SERVICE, AIRCRAFT ETC.

British Aviation Services (Engineering), Ltd.

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Aerocontacts (Ground Equipment), Ltd.
British Brown-Boveri, Ltd.
British Oxygen Gases, Ltd.
Burnley Aircraft Products, Ltd.
General Electric Co., Ltd., The
Murex Welding Processes, Ltd.
Petbow, Ltd.
Philips Electrical, Ltd.
Quasi-Arc, Ltd.
Sanders (Electronics), Ltd., W. H.
Sciaky Electric Welding Machines, Ltd.
Siemens Edison Swan, Ltd.
Vernons Industries, Ltd.

WELDING EQUIPMENT, OTHER THAN ELECTRICAL

Aerocontacts (Ground Equipment), Ltd.
British Oxygen Gases, Ltd.
Burndept, Ltd.
Burnley Aircraft Products, Ltd.
Scottish Distributors, Ltd.
Siebe, Gorman and Co., Ltd.

WHEELS, CASTOR, ETC., INDUSTRIAL
(see also specific items)

Aerocontacts (Ground Equipment), Ltd.
Aero Controls, Ltd.
Airline Air Spares, Ltd.
Autoset (Production), Ltd.
Aviation Traders (Engineering), Ltd.
Flexello Castors and Wheels, Ltd.
Newton and Co., H. T.
Palmer Aero Products, Ltd.

WHEELS, LANDING

Dunlop Rubber Co., Ltd.
Skylines Aircraft Components, Ltd.
Walter, A. J.

WIND TUNNELS AND EQUIPMENT

Aerocontacts (Ground Equipment), Ltd.
Airscrew Co., and Jicwood, Ltd., The
British Brown-Boveri, Ltd.
English Electric Co., Ltd., The
General Electric Co., Ltd., The
Harvey and Co. (London), Ltd., G. A.
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Honeywell Controls, Ltd.
Morfax, Ltd.
Scottish Distributors, Ltd.
Short and Mason, Ltd.
Simmons and Hawker, Ltd.
Woodside Die Sinking Co., Ltd.

WIRE AND WIRE ROPES
(see also Cables, Control)

Aircraft Materials, Ltd.
Booth and Co., Ltd., James
British Ropes, Ltd.
Fox and Co., Ltd., Samuel
Heckford, Ltd., Arthur E.
Northern Aluminium Co., Ltd.
Park Gate Iron and Steel Co., Ltd., The
Rapp, Ltd., Leo
Rollet and Co., Ltd., H.
Sparklets, Ltd.
Stainless Steel Wire Co., Ltd.
Talbot Stead Tube Co., Ltd.

WIRING AND WIRING ACCESSORIES, AIRCRAFT AND ENGINE

Aircraft Marine Products (Great Britain), Ltd.
British Insulated Callender's Cables, Ltd.
British Thomson-Houston Co., Ltd., The
Brown Brothers (Aircraft), Ltd.
C.W.C. Equipment, Ltd.
E.R.S. (London), Ltd.
Electrocon, Ltd.
Minnesota Mining and Manufacturing Co., Ltd.
Parman Aircraft Supplies, Ltd.
Plessey Co., Ltd., The
Rist's Wires and Cables, Ltd.
Rotax, Ltd.
Stewart Aeronautical Supply Co., Ltd.
Telegraph Construction and Maintenance Co., Ltd., The

WOOD, PROCESSED

Airwork, Ltd.
Coin Insulation, Ltd.
Eagle Aircraft Services, Ltd.
Hordern-Richmond (Sales), Ltd.
Parnall and Co., Ltd., Geo.
Reynolds (Packaging), Ltd.
Saro Laminated Wood Products, Ltd.
Short and Mason, Ltd.
Walker (A. D.), Ltd., James

ADDRESSES OF MANUFACTURERS AND SUPPLIERS

A.J.W. (Instruments), Ltd., Gatwick Airport, Horley, Surrey. T: Livingstone 8811. TA: Cubeng, London.

Abbey Panel and Sheet Metal Co., Ltd., The, Bayton Road, Exhall, Nr. Coventry. T: Bedworth 2071.

Accles and Pollock, Ltd., Oldbury, Birmingham. T: Broadwell 1500. TA: Accles, Oldbury, Telex.

Acton Bolt, Ltd., 26 Chase Road, London, N.W.10. T: Elgar 5775. TA: Finethread, Harles, London.

Adam and Lane and Neeve, Ltd., Falcon Works, Copperfield Road, Mile End, E.3. T: Advance 2345. TA: Adaptandum, Bochurch, London.

Adcola Products, Ltd., Gauden Road, Clapham High Street, London, S.W.4. T: Macaulay 3101 and 4272.

Aero Controls, Ltd., Industrial Estate, Weedon Road, Northampton. T: Northampton 33131.

Aero Maintenance Equipment, Ltd., 100a Clapham Park Road, London, S.W.4. T: Macaulay 2477-8. TA: Amble, London, S.W.4.

Aero Research, Ltd.—See CIBA (A.R.L.), Ltd.

Aerocontacts (Aircraft Distributors), Ltd., Gatwick Airport, Horley, Surrey. T: Horley 5511. TA: Aerocon, Horley.

Aerocontacts (Ground Equipment), Ltd., Gatwick Airport, Horley, Surrey. T: Horley 5511. TA: Aeracon, Horley.

Aerocontacts (Sales), Ltd., Gatwick Airport, Surrey. T: Horley 5511. TA: Aerocon, Horley.

Aerofilms, Ltd., Chester Road, Boreham Wood, Herts. T: Elstree 2214. TA: Astereo, Borehamwood.

Aerogalley, Gatwick Airport, Horley, Surrey. T: Horley 5511 and Livingstone 8811. TA: Aerocon, Horley.

Aero Controls, Ltd., universal joint.

Aerolex, Ltd., Bridge Road, Camberley, Surrey. T: Camberley 1500. TA: Aerolex, Camberley.

Aeronautical Trades and Manufacturing Co., Ltd., Aero House, 1 Wyndham Road, London, S.E.5. T: Rodney 7209. TA: Aertradman, London

Aeroplastics, Ltd., Earl Haig Road, Hillington, Glasgow, S.W.2. T: Halfway 1683. TA: Aeroplastic, Glasgow Telex.

Air Engine Services (U.S.-U.K.), Ltd., Blindley Heath, Lingfield, Surrey. T: Lingfield 2646. TA: Pratwit, Blindley Heath.

Aircraft Marine Products (Great Britain), Ltd., 60 Kingly Street, London, W.1. T: Regent 2517-8. TA: Amplo, London.

Aircraft Materials, Ltd., Midland Road, London, N.W.1. T: Euston 6151. TA: Airworthy, Norwest.

Aircraft Unit Engineering Co., 18-19 Greenhill Parade, Great North Road, New Barnet, Herts. T: Barnet 6471.

Airline Air Spares, Ltd., Southend Airport, Southend-on-Sea, Essex. T: Rochford 56881/2/3. TA: Telex 1946, c/o Overseas Aviation (C.I.), Ltd.

Airmed, Ltd., South Road, Temple Fields Estate, Harlow, Essex. T: Harlow 24331/2. TA: Airmed, Harlow.

Airscrew Co. and Jicwood, Ltd., The, Weybridge, Surrey. T: Weybridge 2242. TA: Airscrew, Weybridge.

Air Service Training, Ltd., Hamble, Southampton, Hants. T: Hamble 3001 (9 lines). TA: Training, Hamble.

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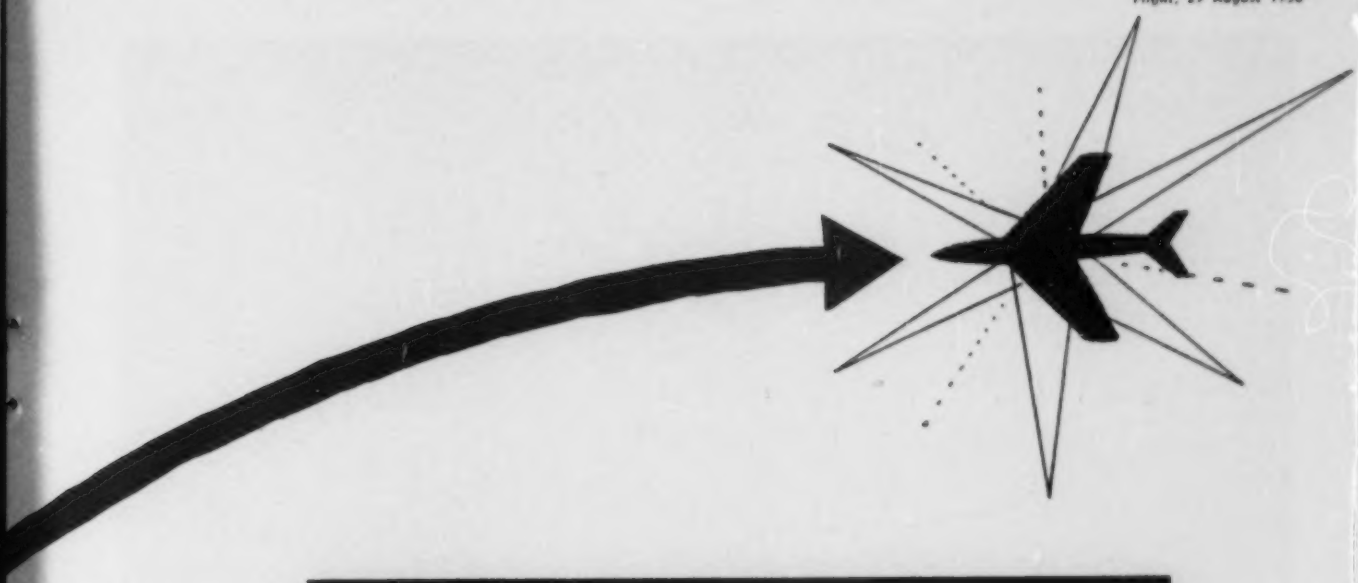

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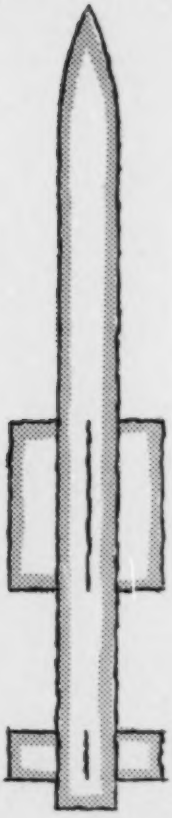

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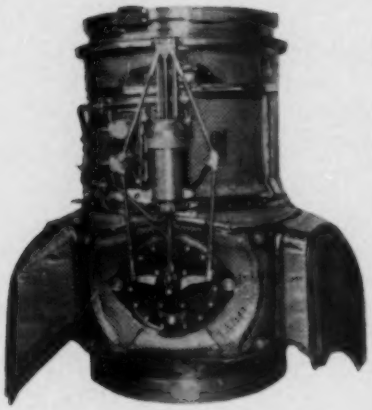
We have supplied heat exchangers for the following aircraft, amongst many others: the 'Britannia,' the 'Vanguard,' the 'Viscount,' the 'Herald,' the 'A.W.650' and the 'Friendship.'

HEAT INSULATION?



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Construction is of silica refractory cased in .004in stainless steel, the steel being dimpled for greater rigidity. They are completely sealed against the ingress of fuel, and are fully approved by the A.R.B.

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STANDS Nos. 7 & 146
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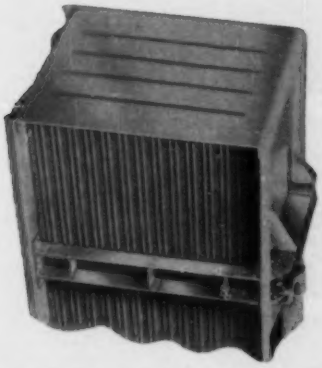

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It really does make the impossible possible. Design inaccessible joints—as many as you wish. Use aluminium thin as foil. Think in terms of very close tolerances. All these things you can do. And you can combine them in units so small, so light and so efficient that it would be *impossible* to make them by any other method.

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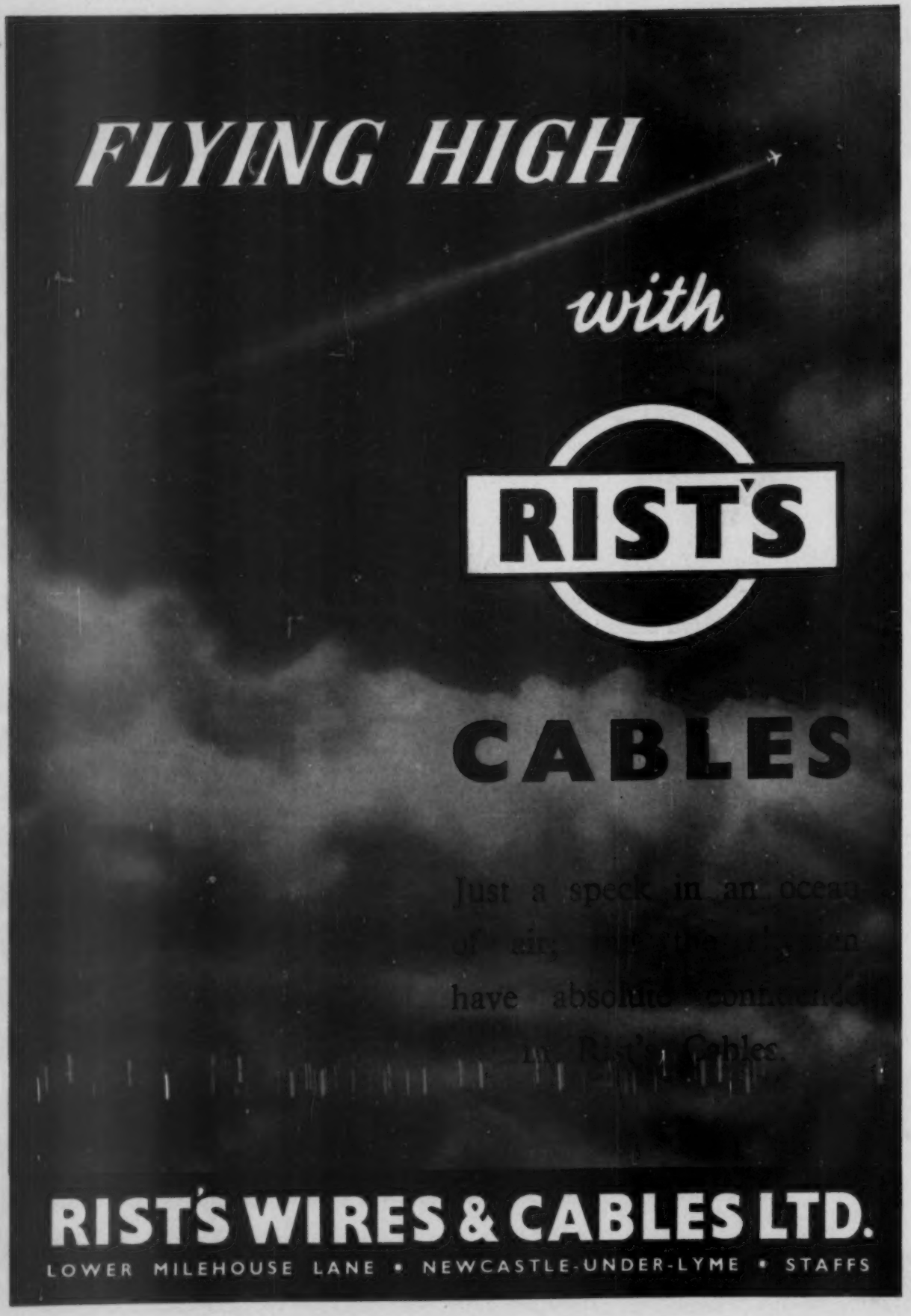
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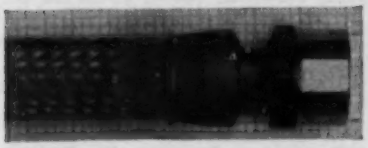
Air Trainers Link, Ltd., Bicester Road, Aylesbury, Bucks. T: Aylesbury 4611. TA: Trainair, Aylesbury.
Airwork, Ltd., Airwork House, 35 Piccadilly, London, W.1. T: Regent 8494. TA: Airwork, Piccy.
Albright and Wilson, Ltd., Knightsbridge Green, London, S.W.1. T: Kensington 3422. TA: Albriwil, Wesphone, London.
Aldis Brothers, Ltd., Priory Works, Sarehole Road, Hall Green, Birmingham 28. T: Springfield 3343/6. TA: Optical, Birmingham.
Aluminium Corporation, Ltd., 30 Charles II Street, London, S.W.1. T: Trafalgar 3104. TA: Fluxode, Piccy.
Amal, Ltd., Holdford Road, Witton, Birmingham, 6. T: Birchfields 4571. TA: Amalcarb, Phone, Birmingham 6.
Amphenol (Great Britain), Ltd., Victoria Road, Burgess Hill, Sussex. T: Burgess Hill 85616.
Andec, Ltd., Bennet Road, Reading, Berkshire. T: Reading 82401.
Anodising and Platings, Ltd., Radcliffe, Lancs. T: Radcliffe 2637.
Anticoustic Co., The, 204 High Street, Guildford, Surrey. T: Guildford 66488.
Ardente Acoustic Laboratories, Ltd., 8-12 Minerva Road, North Acton, London, N.W.10. T: Elgar 3923. TA: Hailer, London.
Armstrong Siddeley Motors, Ltd., Parkside, Coventry. T: Coventry 62666. TA: Sidarm, Coventry.
Armstrong Whitworth Aircraft, Ltd., Sir W. G., Baginton, Nr. Coventry, Warwicks. T: Tollbar 2261. TA: Aircraft, Coventry, Telex.



Avica Equipment hose coupling, Type W.

Aston and Co., Ltd., E. S., 5 Sebastian Street, London, E.C.1. T: Clerkenwell 2179.
Astralux, Ltd., 98 New Street, Brightlingsea, Colchester, Essex. T: Brightlingsea 275. TA: Astralux, Brightlingsea.
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Autoset (Production), Ltd., Stour Street, Birmingham 18. T: Edgbaston 1143.
Avery-Hardoll, Ltd., Oakcroft Road, Chessington, Surrey. T: Elmbridge 5221. TA: Hardolpump, Phone, London.
Aviation Developments, Ltd., Kingsbourne House, 229/231 High Holborn, London, W.C.1. T: Chancery 8601. TA: Avidev, Holb, London.
Aviation Traders (Engineering), Ltd., 21 Wigmore Street, London, W.1. T: Museum 7791. TA: Aviatrade, Wesdo, London.
Avica Equipment, Ltd., Mark Road, Hemel Hempstead, Herts. T: Boxmoor 4711. TA: Avica, Hemel Hempstead.
Avimo, Ltd., Herbert Street, Taunton, Somerset. T: Taunton 3634-5. TA: Avimo, Taunton.
Avo, Ltd., Avocet House, 92-96 Vauxhall Bridge Road, London, S.W.1. T: Victoria 3404. TA: Avocet, Sowest, London.
Aylesbury Turned Parts (True Screws), Ltd., Aylesbury, Bucks. T: Aylesbury 2424.

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BP Trading Ltd. Britannic House, Finsbury Circus, London, E.C.2. T: National 1200. TA: Airbeepee, London.
B.R.D. Co., Ltd., Dumblederry Lane, Aldridge, Staffs. T: Walsall 6551-9.
B.S.T. Aeronautical Co., Ltd., Blackbushe Airport, Camberley, Surrey. T: Camberley 1600.
Baines, Ltd., C.O.H., 77 Renshaw Street, Liverpool 1. T: Royal 4961/2. Also Judd Road, Tonbridge, Kent. T: Tonbridge 2795/3928.
Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1. T: Sloane 0898. TA: Bakelite, Sowest, London.
Bardolph and Partners, Ltd., 1 Robert Street, London, W.C.2. T: Trafalgar 1927. TA: Loebwyn, Rand, London.
Baxter, Woodhouse and Taylor, Ltd., Woodside, Poynton, Stockport, Cheshire. T: Poynton 2261-3. TA: Canary, Poynton.
Baynes Aircraft Interiors, Ltd., Langley Aerodrome, Langley, Bucks. T: Langley 451-3. TA: Baynecraft, Bucks.
Bell Precision Engineering Co., Ltd., Victoria Works, High Street, Crawley, Sussex. T: Crawley 25757/8/9. TA: Jigs, Crawley.
Belling and Lee, Ltd., Great Cambridge Road, Enfield, Middlesex. T: Enfield 3322. TA: Radiobel, Enfield.
Bellman Hangars, Hobart House, Grosvenor Place, London, S.W.1. T: Sloane 5259. TA: Unitstruct, London.
Bell's Asbestos and Engineering, Ltd., Bestobell Works, Slough, Bucks. T: Slough 25151. TA: Bestobell, Slough.
Bennett (Hyde), Ltd., Boston Mills, Hyde, Cheshire. T: Hyde 1377/8/9. TA: Benneco, Phone, Hyde.
Birkett, Billington and Newton, Ltd., T. M. Hanley, Stoke-on-Trent. T: Stoke-on-Trent 22184-7. TA: Birkett, Hanley.
Birmetals, Ltd., Woodgate Works, Quinton, Birmingham, 32. T: Woodgate 2253. TA: Birmetals, Birmingham 32.
Birmingham Aluminium Casting (1903) Co., Ltd., Birmid Works, Smethwick 40, Birmingham. T: Smethwick 1431. TA: Birmal, Smethwick.
Blackburn and General Aircraft, Ltd., Brough, E. Yorks. T: Brough 121. TA: Propellers, Brough.
Blake (Brentwood), Ltd., Geo. A., Kings Road, Brentwood, Essex. T: Brentwood 1146, 3087 and 242. TA: Blake, Brentwood.
Bloctube Controls, Ltd., Bicester Road, Aylesbury, Bucks. T: Aylesbury 3494-6. TA: Bloctube, Aylesbury.
Boorn and Co., Ltd., Thomas, Venn Street, Clapham, London, S.W.4. T: Macaulay 1181. TA: Plumbago, Clapcom, London.
Booth and Co., Ltd., James, Argyle Street, Nechells, Birmingham, 7. T: Birmingham East 1521. TA: Booth, Bham Telex.
Boulton Paul Aircraft, Ltd., Wolverhampton, Staffs. T: Pordhouses 3191. TA: Aircraft, Wolverhampton.
Bradley, Ltd., G. and R., Electral House, Neasden Lane, London, N.W.10. T: Gladstone 0012. TA: Bradelec London N.W.10.
Bramah and Co., Ltd., J. R., Devonshire Street, Sheffield 3. T: Sheffield 24278.
Brand and Co., Ltd., R. A., Works Road, Letchworth, Herts. T: Letchworth 1990. TA: Texikoon, Letchworth.
Brent Chemical Products, Ltd., Commerce Road, Brentford, Middx. T: Ealing 0077. TA: Ardrox, Brentford, Telex.
Bretts Precision Engineering Co., Ltd., 242 High Road, Loughton, Essex. T: Loughton 1052.
Bristol Aircraft, Ltd., Filton House, Filton, Bristol. T: Bristol 3831. TA: Aviation, Bristol.
British Aluminium Co., Ltd., The, Norfolk House, St. James's Square, London, S.W.1. T: Whitehall 7868. TA: Britalumin, London, Telex.
British Aviation Insurance Company, Ltd., The, 3/4 Lime Street, London, E.C.3. T: Mansion House 0444. TA: Aviacoy, Lime, London.
British Aviation Services (Engineering), Ltd. Silver City House, Brompton Road, London, S.W.3. T: Camberley 1600. TA: Baseng, Camberley.
British Brown-Boveri, Ltd., 75 Victoria Street, London, S.W.1. T: Abbey 5777. TA: Reactance, London, Telex.
British Ermeto Corporation, Ltd., Beacon Works, Hargrave Road, Maidenhead, Berks. T: Maidenhead 5100-9. TA: Gramber, Maidenhead.
British Insulated Callender's Cables, Ltd., 21 Bloomsbury Street, London, W.C.1. T: Museum 1600. TA: Bicalbest, London, Telex.
British Manufactured Bearings, Co., Ltd., High Street, Crawley, Sussex. T: Crawley 1030. TA: Briman, Crawley.
British Messier, Ltd., Cheltenham Road, Gloucester. T: Churchdown 3281. TA: Messier, Phone, Gloucester.
British Oxygen Aro Equipment, Ltd., The Pinnacles, Western Industrial Estate, Harlow, Essex. T: Harlow 26891.
British Oxygen Gases, Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1. T: Whitehall 9777. TA: Oxygen, Piccy, London.
British Refrasil Co., Ltd., The, Stillington Works, Stillington, Stockton-on-Tees, Co. Durham. T: Stillington 351. TA: Refrasil, Stillington, Co. Durham.
British Ropes, Ltd., Carr Hill, Doncaster. T: Doncaster 4010. TA: Britrope, Doncaster Telex.
British Thomson-Houston Co., Ltd., The, Rugby, Warwickshire. T: Coventry 2121. TA: Asteroidal, Telex, Coventry.
British Timken, Ltd., Duston, Northampton. T: Northampton 4921. TA: Britimken, Northampton, Telex.
Brockhouse and Co., Ltd., J., Victoria Works, Hill Top, West Bromwich, Staffs. T: Wednesbury 0243. TA: Brockhouse, West Bromwich.
Brooklands Aviation, Ltd., Beech Hollow, Vale Road, Oatlands Park, Weybridge, Surrey. T: Weybridge 3821. TA: Aviation, Byfleet.
Brown, Ltd., S. G., Shakespeare Street, Watford, Herts. T: Watford 7241. TA: Sidbrownix, Watford.
Brown Bayley Steels, Ltd., Leeds Road, Sheffield 9. T: Sheffield 41031.
Brown Brothers (Aircraft), Ltd., Bedford Road, Northampton. T: Northampton 4940. TA: Imbrowned, Northampton.
Brown Construction Equipment, Ltd., David, Hanworth Park, Feltham, Middx. T: Feltham 2291. TA: Intrac, Feltham.
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Brown Industries, Ltd., David, Machine Tool Division, Britannia Works, Sherbourne Street, Manchester. T: Blackfriars 4711. TA: Britannia, Manchester.
Brush Crystal Co., Ltd., Shore Road, Hythe, Nr. Southampton. T: Hythe 3031/2. TA: Brudev, Hythe, Southampton.
Bryans Aeroquipment, Ltd., 1 Willow Lane, Mitcham Junction, Surrey. T: Mitcham 3134. TA: Bryquip, Southphone, London.
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Burnley Aircraft Products, Ltd., Fulledge Works, Holmes Street, Burnley, Lancs. T: Burnley 3121-2. TA: Aircraft, Burnley.

CIBA (A.R.L.), Ltd., Duxford, Cambridge. T: Sawston 2121. TA: Aerodux, Cambridge.
C.J.C. Developments (Portsmouth), Ltd., Fitzherbert Road, Farlington, Portsmouth. T: Cosham 76437-9. TA: Tangible, Portsmouth, Telex 8689.
C.W.C. Equipment, Ltd., Acorn Works, Kings Grove, Maidenhead, Berks. T: Maidenhead 2275. TA: Durasquip, Maidenhead.
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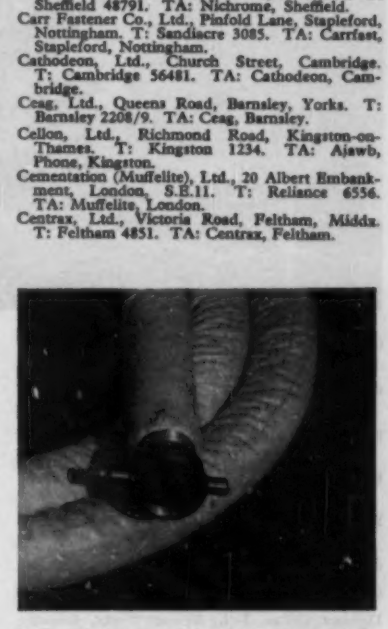
Carr Fastener Co., Ltd., Pinfold Lane, Stapleford, Nottingham. T: Sandiacre 3085. TA: Carrfast, Stapleford, Nottingham.
Cathodeon, Ltd., Church Street, Cambridge. T: Cambridge 56481. TA: Cathodeon, Cambridge.
Ceag, Ltd., Queens Road, Barnsley, Yorks. T: Barnsley 2208/9. TA: Ceag, Barnsley.
Cellon, Ltd., Richmond Road, Kingston-on-Thames. T: Kingston 1234. TA: Ajawb, Phone, Kingston.
Cementation (Muffelite), Ltd., 20 Albert Embankment, London, S.E.11. T: Reliance 6556. TA: Muffelite, London.
Centrax, Ltd., Victoria Road, Feltham, Middx. T: Feltham 4851. TA: Centrax, Feltham.



Bell's Asbestos and Engineering, Ltd.: insulated hose for conveying refrigerated air.

Chelton (Electrostatics), Ltd., Marlow, Bucks. T: Marlow 1063. TA: Chelton, Marlow.
Chesterfield Tube Co., Ltd., The, Derby Road, Chesterfield, Derbyshire. T: Chesterfield 2201. TA: Tubes, Chesterfield.
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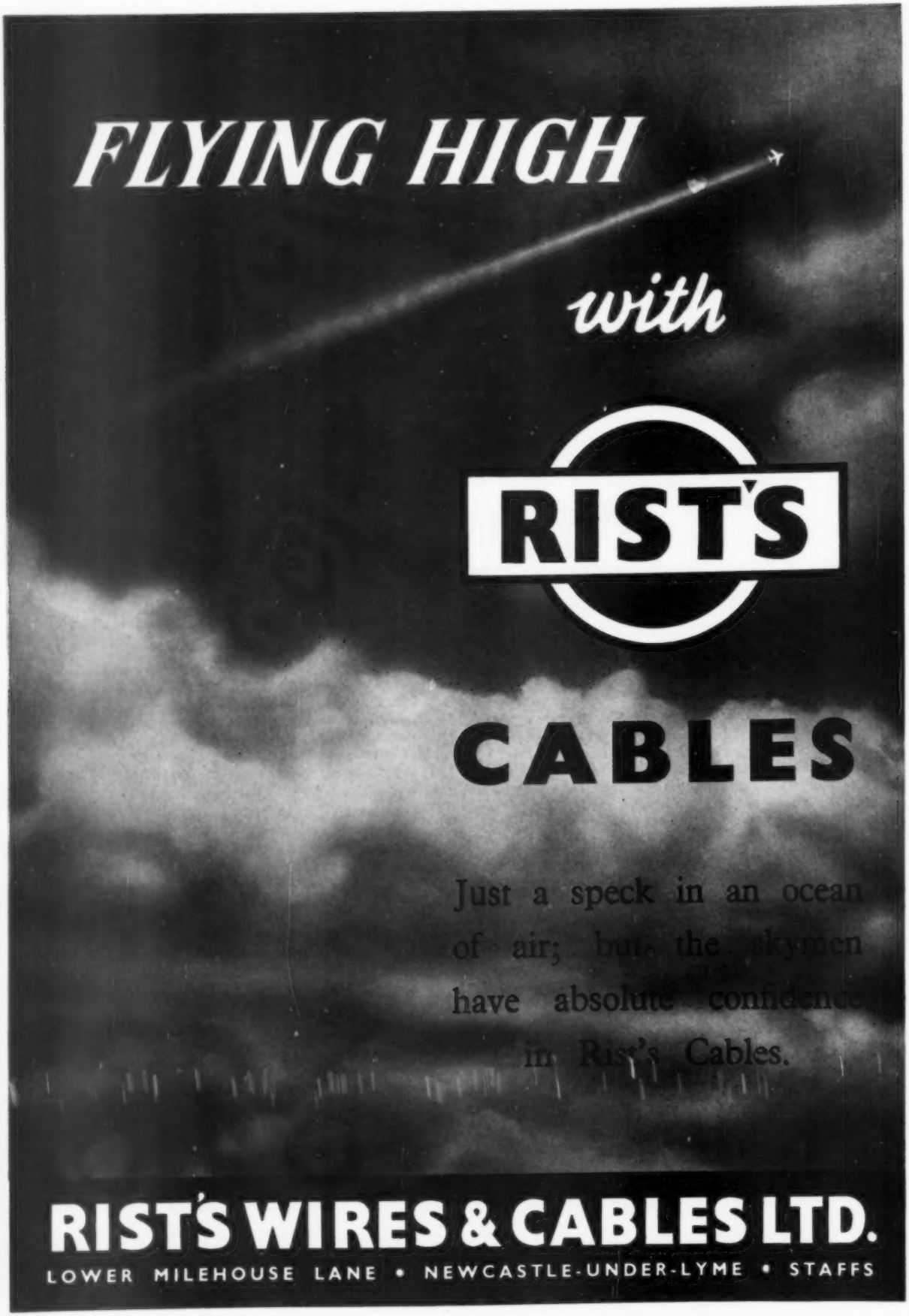
Coin Insulation, Ltd., Coin Works, Woking, Surrey. T: Woking 4789/4790. TA: Coin, Woking.
Cole, Ltd., E. K., Ekco Works, Southend-on-Sea, Essex. T: Southend-on-Sea 49491. TA: Ekco, Southend.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with
RIST'S
CABLES
Just a speck in an ocean of air; but the skymen have absolute confidence in Rist's Cables.
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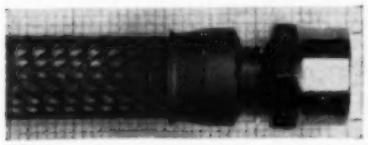
ANCILLARY INDUSTRY 1958...

Air Trainers Link, Ltd., Bicester Road, Aylesbury, Bucks. T: Aylesbury 4611. TA: Trainair, Aylesbury.
Airwork, Ltd., Airwork House, 35 Piccadilly, London, W.1. T: Regent 8494. TA: Airwork, Piccy.
Albright and Wilson, Ltd., Knightsbridge Green, London, S.W.1. T: Kensington 3422. TA: Albriwil, Wesphone, London.
Aldis Brothers, Ltd., Priory Works, Sarehole Road, Hall Green, Birmingham 28. T: Springfield 3343/6. TA: Optical, Birmingham.
Aluminium Corporation, Ltd., 30 Charles II Street, London, S.W.1. T: Trafalgar 3104. TA: Fluxode, Piccy.
Amal, Ltd., Holdford Road, Witton, Birmingham, 6. T: Birchfields 4571. TA: Amalcarb, Phone, Birmingham 6.
Amphenol (Great Britain), Ltd., Victoria Road, Burgess Hill, Sussex. T: Burgess Hill 85616.
Andec, Ltd., Bennet Road, Reading, Berkshire. T: Reading 82401.
Anodising and Platings, Ltd., Radcliffe, Lancs. T: Radcliffe 2637.
Anticoustic Co., The, 204 High Street, Guildford, Surrey. T: Guildford 66488.
Ardente Acoustic Laboratories, Ltd., 8-12 Minerva Road, North Acton, London, N.W.10. T: Elgar 3923. TA: Hailer, London.
Armstrong Siddeley Motors, Ltd., Parkside, Coventry. T: Coventry 62666. TA: Sidarm, Coventry.
Armstrong Whitworth Aircraft, Ltd., Sir W. G., Baginton, Nr. Coventry, Warwicks. T: Tollbar 2261. TA: Aircraft, Coventry, Telex.



Avica Equipment hose coupling, Type W.

Aston and Co., Ltd., E. S., 5 Sebastian Street, London, E.C.1. T: Clerkenwell 2179.
Astralux, Ltd., 98 New Street, Brightlingsea, Colchester, Essex. T: Brightlingsea 275. TA: Astralux, Brightlingsea.
Atlas Plating Works, Ltd., 79 Avenue Road, Acton, London, W.8. T: Acorn 1102/3/4.
Attewell and Sons, Ltd., B., Reflection Works, Iver, Bucks. T: Iver 1102. TA: Reflection, Iver.
Auto-Klean Strainers, Ltd., Lascar Works, Hounslow, Middlesex. T: Hounslow 7722. TA: Auto-Klean, Hounslow.
Autoset (Production), Ltd., Stour Street, Birmingham 18. T: Edgbaston 1143.
Avery-Hardoll, Ltd., Oakcroft Road, Chessington, Surrey. T: Elmbridge 5221. TA: Hardolpump, Phone, London.
Aviation Developments, Ltd., Kingsbourne House, 229/231 High Holborn, London, W.C.1. T: Chancery 8601. TA: Avidev, Holb, London.
Aviation Traders (Engineering), Ltd., 21 Wigmore Street, London, W.1. T: Museum 7791. TA: Aviatrade, Wesdo, London.
Avica Equipment, Ltd., Mark Road, Hemel Hempstead, Herts. T: Boxmoor 4711. TA: Avica, Hemel Hempstead.
Avimo, Ltd., Herbert Street, Taunton, Somerset. T: Taunton 3634-5. TA: Avimo, Taunton.
Avo, Ltd., Avocet House, 92-96 Vauxhall Bridge Road, London, S.W.1. T: Victoria 3404. TA: Avocet, Sowest, London.
Aylesbury Turned Parts (True Screws), Ltd., Aylesbury, Bucks. T: Aylesbury 2424.

B.B. Chemical Co., Ltd., Ulverscroft Road, Leicester. T: Leicester 20175. TA: Matchless, Leicester.
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Baxter, Woodhouse and Taylor, Ltd., Woodside, Poynton, Stockport, Cheshire. T: Poynton 2261-3. TA: Canary, Poynton.
Baynes Aircraft Interiors, Ltd., Langley Aerodrome, Langley, Bucks. T: Langley 451-3. TA: Baynzcraft, Bucks.
Bell Precision Engineering Co., Ltd., Victoria Works, High Street, Crawley, Sussex. T: Crawley 25757/8/9. TA: Jigs, Crawley.
Belling and Lee, Ltd., Great Cambridge Road, Enfield, Middlesex. T: Enfield 3322. TA: Radiobel, Enfield.
Bellman Hangars, Hobart House, Grosvenor Place, London, S.W.1. T: Sloane 5259. TA: Unitstruct, London.
Bell's Asbestos and Engineering, Ltd., Bestobell Works, Slough, Bucks. T: Slough 25151. TA: Bestobell, Slough.
Bennett (Hyde), Ltd., Boston Mills, Hyde, Cheshire. T: Hyde 1377/8/9. TA: Benneco, Phone, Hyde.
Birkett, Billington and Newton, Ltd., T. M. Hanley, Stoke-on-Trent. T: Stoke-on-Trent 22184-7. TA: Birkett, Hanley.
Birmetals, Ltd., Woodgate Works, Quinton, Birmingham, 32. T: Woodgate 2253. TA: Birmetals, Birmingham 32.
Birmingham Aluminium Casting (1903) Co., Ltd., Birmid Works, Smethwick 40, Birmingham. T: Smethwick 1431. TA: Birmal, Smethwick.
Blackburn and General Aircraft, Ltd., Brough, E. Yorks. T: Brough 121. TA: Propellers, Brough.
Blake (Brentwood), Ltd., Geo. A., Kings Road, Brentwood, Essex. T: Brentwood 1146, 3087 and 242. TA: Blake, Brentwood.
Bloctube Controls, Ltd., Bicester Road, Aylesbury, Bucks. T: Aylesbury 3494-6. TA: Bloctube, Aylesbury.
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Booth and Co., Ltd., James, Argyle Street, Nechells, Birmingham, 7. T: Birmingham East 1521. TA: Booth, Bham Telex.
Boulton Paul Aircraft, Ltd., Wolverhampton, Staffs. T: Fordhouses 3191. TA: Aircraft, Wolverhampton.
Bradley, Ltd., G. and E., Electral House, Neasden Lane, London, N.W.10. T: Gladstone 0012. TA: Bradelec London N.W.10.
Bramah and Co., Ltd., J. R., Devonshire Street, Sheffield 3. T: Sheffield 24228.
Brand and Co., Ltd., R. A., Works Road, Letchworth, Herts. T: Letchworth 1990. TA: Texikoon, Letchworth.
Brent Chemical Products, Ltd., Commerce Road, Brentford, Middx. T: Ealing 0077. TA: Ardrox, Brentford, Telex.
Bretts Precision Engineering Co., Ltd., 242 High Road, Loughton, Essex. T: Loughton 1052.
Bristol Aircraft, Ltd., Filton House, Filton, Bristol. T: Bristol 3831. TA: Aviation, Bristol.
British Aluminium Co., Ltd., The, Norfolk House, St. James's Square, London, S.W.1. T: Whitehall 7868. TA: Britalumin, London, Telex.
British Aviation Insurance Company, Ltd., The, 3/4 Lime Street, London, E.C.3. T: Mansion House 0444. TA: Aviacoy, Lime, London.
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British Ermeto Corporation, Ltd., Beacon Works, Hargrave Road, Maidenhead, Berks. T: Maidenhead 5100-9. TA: Gramber, Maidenhead.
British Insulated Callender's Cables, Ltd., 21 Bloomsbury Street, London, W.C.1. T: Museum 1600. TA: Bicalbest, London, Telex.
British Manufactured Bearings, Co., Ltd., High Street, Crawley, Sussex. T: Crawley 1030. TA: Briman, Crawley.
British Messier, Ltd., Cheltenham Road, Gloucester. T: Churchdown 3281. TA: Messier, Phone, Gloucester.
British Oxygen Aro Equipment, Ltd., The Pinnacles, Western Industrial Estate, Harlow, Essex. T: Harlow 26891.
British Oxygen Gases, Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1. T: Whitehall 9777. TA: Oxygen, Piccy, London.
British Refrasil Co., Ltd., The, Stillington Works, Stillington, Stockton-on-Tees, Co. Durham. T: Stillington 351. TA: Refrasil, Stillington, Co. Durham.
British Ropes, Ltd., Carr Hill, Doncaster. T: Doncaster 4010. TA: Britrope, Doncaster Telex.
British Thomson-Houston Co., Ltd., The, Rugby, Warwickshire. T: Coventry 2121. TA: Asteroidal, Telex, Coventry.
British Timken, Ltd., Duston, Northampton. T: Northampton 4921. TA: Britimken, Northampton, Telex.
Brockhouse and Co., Ltd., J., Victoria Works, Hill Top, West Bromwich, Staffs. T: Wednesbury 0243. TA: Brockhouse, West Bromwich.
Brooklands Aviation, Ltd., Beech Hollow, Vale Road, Oatlands Park, Weybridge, Surrey. T: Weybridge 3821. TA: Aviation, Byfleet.
Brown, Ltd., S. G., Shakespeare Street, Watford, Herts. T: Watford 7241. TA: Sidbrownix, Watford.
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Brown Brothers (Aircraft), Ltd., Bedford Road, Northampton. T: Northampton 4940. TA: Imbrowned, Northampton.
Brown Construction Equipment, Ltd., David, Hanworth Park, Feltham, Middx. T: Feltham 2291. TA: Intrac, Feltham.
Brown Industries, Ltd., David, Foundries Division, Penistone, Nr. Sheffield. T: Penistone 3311. TA: Dabrocast, Penistone.
Brown Industries, Ltd., David, General Gear Division, Park Works, Lockwood, Huddersfield. T: Huddersfield 3500. TA: Gearing, Huddersfield.
Brown Industries, Ltd., David, Machine Tool Division, Britannia Works, Sherbourne Street, Manchester. T: Blackfriars 4711. TA: Britannia, Manchester.
Brush Crystal Co., Ltd., Shore Road, Hythe, Nr. Southampton. T: Hythe 3031/2. TA: Brudev, Hythe, Southampton.
Bryans Aeroquipment, Ltd., 1 Willow Lane, Mitcham Junction, Surrey. T: Mitcham 5134. TA: Bryquip, Souphone, London.
Burgess and Co., Ltd., G. N., Hanworth Trading Estate, Hampton Road West, Feltham, Middlesex. T: Feltham 4871. TA: Cobecycle, Feltham.
Burndept, Ltd., West Street, Erith, Kent. T: Erith 3080. TA: Burndept, Erith.
Burnley Aircraft Products, Ltd., Fulledge Works, Holmes Street, Burnley, Lancs. T: Burnley 3121-2. TA: Aircraft, Burnley.

CIBA (A.R.L.), Ltd., Duxford, Cambridge. T: Sawston 2121. TA: Aerodux, Cambridge.
C.J.C. Developments (Portsmouth), Ltd., Fitzherbert Road, Farlington, Portsmouth. T: Cosham 76437-9. TA: Tangible, Portsmouth, Telex 8689.
C.W.C. Equipment, Ltd., Acorn Works, Kings Grove, Maidenhead, Berks. T: Maidenhead 2275. TA: Duraquip, Maidenhead.
Carlisle and Co., Ltd., C. G., Iona Steel Works, 629 Penistone Road, Sheffield 6, Yorkshire. T: Sheffield 48791. TA: Nichrome, Sheffield.
Carr Fastener Co., Ltd., Pinfold Lane, Stapleford, Nottingham. T: Sandiacre 3085. TA: Carrfast, Stapleford, Nottingham.
Cathodeon, Ltd., Church Street, Cambridge. T: Cambridge 56481. TA: Cathodeon, Cambridge.
Ceag, Ltd., Queens Road, Barnsley, Yorks. T: Barnsley 2208/9. TA: Ceag, Barnsley.
Cellon, Ltd., Richmond Road, Kingston-on-Thames. T: Kingston 1234. TA: Ajawb, Phone, Kingston.
Cementation (Muffelite), Ltd., 20 Albert Embankment, London, S.E.11. T: Reliance 6556. TA: Muffelite, London.
Centrax, Ltd., Victoria Road, Feltham, Middx. T: Feltham 4851. TA: Centrax, Feltham.

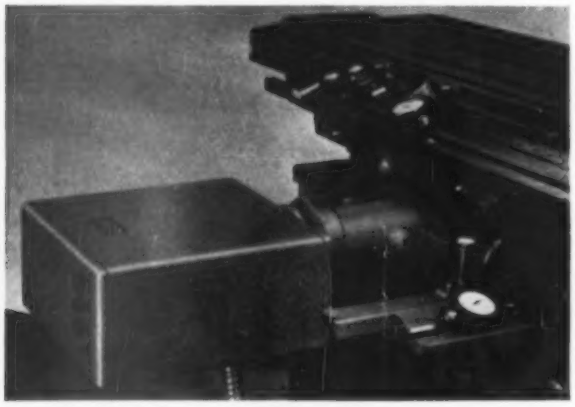
Bell's Asbestos and Engineering, Ltd.: insulated hose for conveying refrigerated air.

Chelton (Electrostatics), Ltd., Marlow, Bucks. T: Marlow 1063. TA: Chelton, Marlow.
Chesterfield Tube Co., Ltd., The, Derby Road, Chesterfield, Derbyshire. T: Chesterfield 2201. TA: Tubes, Chesterfield.
Chloride Batteries, Ltd., Exide Works, Clifton Junction, Swinton, Manchester. T: Swinton 2011. TA: Chlorexide, Manchester.
Cinetra Manufacturing Co., Ltd., 12 Oval Road, Camden Town, London, N.W.1. T: Gulliver 2353 and 4085. TA: Cinetra, Norwest, London.
Clapham Park Motors, Ltd., 100a Clapham Park Road, London, S.W.4. T: Macaulay 2477. TA: Amble London S.W.4.
Clifford Products, Ltd., Imperial Works, Friar Street, Wednesbury, Staffs. T: Wednesbury 0784. TA: Cliffpro, Wednesbury.
Coin Insulation, Ltd., Coin Works, Woking, Surrey. T: Woking 4789/4790. TA: Coin, Woking.
Cole, Ltd., E. K., Ekco Works, Southend-on-Sea, Essex. T: Southend-on-Sea 49491. TA: Ekco, Southend.

ANCILLARY INDUSTRY 1958.

Coley and Son (Hounslow), Ltd., R. J., Jubilee Works, Chapel Road, Hounslow, Middx. T: Hounslow 2266-8. TA: Metalful, Hounslow, Telex.
Connolly Bros. (Curriers), Ltd., 39-43 Chalton Street, London, N.W.1. T: Euston 1661. TA: Cowhide, London.
Coopers Mechanical Joints, Ltd., Liverpool Road, Slough, Bucks. T: Slough 24511. TA: Endure, Slough.
Copeland and Jenkins, Ltd., Elektron Works, 18 Church Road, Leyton, London, E.10. T: Leytonstone 5464/7. TA: Elektron.
Cornercroft, Ltd., Ace Works, Coventry. T: Coventry 40561. TA: Discs, Coventry.
Cossor, Ltd., A. C., Cossor Instruments, Ltd., and Cossor Radar and Electronics, Ltd., Cossor House, Highbury Grove, London, N.5. T: Canonbury 1234. TA: Cossor, Norphone, London.
Costain, Ltd., Richard, 111 Westminster Bridge Road, London, S.E.1. T: Waterloo 4977. TA: Cosdown, London.
Cox and Son, Ltd., Coxorian Works, Carlisle Road, London, N.W.9. T: Colindale 4001/2. TA: Coxorian, Hyde, London.
Cross Mfg. Co. (1938), Ltd., Combe Down, Bath. T: Combedown 2355/8. TA: Circle, Bath.
Cullum and Co., Ltd., Horace W., The Acoustic Centre, 58 Highgate West Hill, London, N.6. T: Fitzroy 1221. TA: Kulmco, London, N.6.
Dowty Equipment, Ltd., Arle Court, Cheltenham, Glos. T: Cheltenham 53471. TA: Dowtys, Cheltenham.
Dowty Fuel Systems, Ltd., Arle Court, Cheltenham, Glos. T: Cheltenham 53471. TA: Dowtys, Cheltenham.
Dowty Nucleonics, Ltd., Brockhampton Park, Andoversford, Glos. T: Andoversford 391. TA: Invention, Cheltenham.
Dowty Seals, Ltd., Ashchurch, nr. Tewkesbury, Glos. T: Tewkesbury 2271. TA: Ashchurch 43-228.
Dragonair, Ltd., Fitzherbert Road, Farlington, Portsmouth, Hants. T: Cosham 76451-2-3. TA: Evarges, Portsmouth.
Dundas, Ltd., R. K., Dundas House, St. James's Street, London, S.W.1. T: Hyde Park 3717. TA: Dunduk.
Dunlop Rubber Co., Ltd. (Aviation Division), Foleshill, Coventry. T: Coventry 88733. TA: Sound, Coventry.
Durion, Ltd., 11/13 Brunel Road, Westway Factory Estate, Acton. London, W.3. T: Shepherds Bush 5301/2/3/4. TA: Durion, Ealux, London.
Dzus Fastener Europe, Ltd., Farnham Factory Estate, Guildford Road, Farnham, Surrey. T: Farnham 4422. TA: Aduzfast, Farnham.

E.M.C. Engineering Co. (London), Ltd., Southey Works, Southey Road, Tottenham, London, N.15. T: Stamford Hill 2069. TA: E.M.C., Stamford Hill 2069.



Ekco machine-tool control equipment, Type E117.

Curd Components, Ltd., 9 Brownfields, Welwyn Garden City, Herts. T: Welwyn Garden 5471/2. TA: Curdesy, W.G.C.
Curran, Ltd., John, P.O. Box No. 72, Curran Road, Cardiff. T: Cardiff 20641. TA: Narruc, Cardiff.

Dawe Instruments, Ltd., 99-101 Uxbridge Road, Ealing, London, W.5. T: Ealing 6215/7. TA: Dawinst, Ealux, London.
Decca Navigator Co., Ltd., The, 9 Albert Embankment, London, S.E.11. T: Reliance 8111. TA: Decnav, London.
Decca Radar, Ltd., 9 Albert Embankment, London, S.E.11. T: Reliance 8111. TA: Decradar, London.
de Havilland Engine Co., Ltd., The, Leavesden, Herts. T: Garston 4000. TA: Gipsy, Watford.
de Havilland Propellers, Ltd., Hatfield, Herts. T: Hatfield 2300. TA: Props, Telex, Hatfield
Delaney Gallay, Ltd., Vulcan Works, Edgware Road, Cricklewood, London, N.W.2. T: Gladstone 2201.
Derby Aviation, Ltd., Derby Airport, Burnaston, Derby. T: Etwall 323.
Derwent Manufacturing Co., Ltd., Derwent Mills, Cockermouth, Cumberland. T: Cockermouth 2326.
Desoutter Brothers, Ltd., The Hyde, Hendon, London, N.W.9. T: Colindale 6346-9. TA: Despnuco, Hyde, London.
Detuners, Ltd., The Acoustic Centre, 58 Highgate West Hill, London, N.6. T: Fitzroy 1221. TA: Detuners, London, N.6.
"Diamond H" Switches, Ltd., Gunnersbury Avenue, Chiswick, London, W.4. T: Chiswick 6444/8. TA: Diamonhart, Chisk, London.
Direct Photographic Supply Co., 2 Harrow Road, Edgware Road, London, W.2. T: Paddington 7581.
Dobbie McInnes, Ltd., Broomloan Road, Glasgow, S.W.1. T: Govan 2394. TA: Compass, Glasgow.
Docker Brothers, Rotton Park Street, Ladywood, Birmingham 16. T: Edgbaston 4111. TA: Japan, Birmingham.
Douglas Equipment, Ltd., Kingsditch Lane, Tewkesbury Road, Cheltenham. T: Cheltenham 56361/2/3. TA: Douglas Cheltenham.
E.M.I. Electronics, Ltd., Hayes, Middlesex. T: Southall 2468. TA: Emidata, London.
E.M.O. Instrumentation, Ltd., Western Road, Bracknell, Berks. T: Bracknell 675/6/7. TA: Precemo, Bracknell.
E.N.V. Engineering Co., Ltd., Hythe Road, Willesden, London, N.W.10. T: Ladbroke 3622. TA: Envied, Telex, London.
E.R.S. (London), Ltd., 159 Brookwood Road, London, S.W.18. T: Putney 3402-4. TA: E.R.S., Putney 3402.
Eagle Aircraft Services, Ltd., Blackbushe Airport, Camberley, Surrey. T: Yateley 2371. TA: Eagle, Camberley.
Eastern Aero Electrical Services, Ltd., 62 Priory Street, Colchester, Essex. T: Colchester 6173/4 (PBX). TA: Eastaulec.
Eccles (Birmingham), Ltd., Arrow Road, Redditch, Worcs. T: Redditch 3365.
Ekco Electronics, Ltd., Ekco Works, Southend-on-Sea, Essex. T: Southend-on-Sea 49491. TA: Ekco, Southend-on-Sea.
Electrocon, Ltd., Adastral House, Nutfield, Surrey. T: Redhill 5050. TA: Sasco, Redhill.
Electro-Hydraulics, Ltd., Liverpool Road, Warrington, Lancs. T: Warrington 35241. TA: Hydraulics, Warrington.
Elliot Equipment, Ltd., Corys' Buildings, Cardiff. T: Cardiff 3114. TA: Cory, Cardiff.
Elliott Brothers (London), Ltd., Airport Works, Rochester, Kent. T: Tideway 3232. TA: OHN, Telex, London.
Enfield Tool Manufacturing Co., Ltd., The, Alma Road, Ponders End, Middlesex. T: Howard 2774. TA: Entool, Enfield.
English Electric Co., Ltd., The, Marconi House, Strand, London, W.C.2. T: Covent Garden 1234. TA: Enelectico, Estrand, London.
English Steel Castings Corporation, Ltd., English Steel Forge and Engineering Corporation, Ltd., English Steel Rolling Mills Corporation, Ltd., P.O. Box 57, River Don Works, Sheffield, 9. T: Sheffield 41071. TA: Steelcorpo, Sheffield.
English Steel Tool Corporation, Ltd., North Street Works, Openshaw, Manchester. T: Manchester East 1371. TA: Steelcorpo, Manchester.
Equator Wheels and Sections, Ltd., Raglan Street, Wolverhampton. T: Wolverhampton 21605. TA: Sections, Wolverhampton.
Ericsson Telephones, Ltd., 22 Lincoln's Inn Fields, London, W.C.2. T: Holborn 6936. TA: Ericsson, Holborn, London.
Esavian, Ltd., Esavian Works, Stevenage, Herts. T: Stevenage 500. TA: Educational, Stevenage.
Esso Petroleum Co., Ltd., Aviation Department, 101 Piccadilly, London, W.1. T: Grosvenor 4251. TA: Airesso, Audley.
Exactor, Ltd., Exactor Works, Church Way, Edgware, Middx. T: Edgware 0071-2. TA: Exactor, Phone, Edgware.
Export Packing Service, Ltd., Imperial Buildings, 56 Kingsway, W.C.2. T: Chancery 5121. TA: Expac, Westcent, London.

Fairey Air Surveys, Ltd., 24 Bruton Street, London, W.1. T: Mayfair 8791. TA: Airimap, London.
Fairey Aviation Co., Ltd., The, Hayes, Middlesex. T: Hayes 3800. TA: Airily, Telex, London.
Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T: Hamble 2135. TA: Fairey Aviation, Hamble, Hants.
Fawcett, Preston and Co., Ltd. (incorporating Finney Presses), Dock Road, Bromborough, Wirral, Cheshire. T: Rock Ferry 2201. TA: Fawcett, Bromborough.
Feltham and Son, Ltd., Walter H., Imperial Works, Tower Bridge Road, London, S.E.1. T: Hop 1784 (2 lines). TA: Unbagged, Sedist, London.
Ferranti, Ltd., Hollinwood, Lancashire. T: Failsworth 2000. TA: Ferranti, Hollinwood.
Ferranti (Meters), Ltd., Denis, Caernarvon Road, Bangor, North Wales. T: Bangor 3232. TA: Deferranti, Bangor.
Fibreglass, Ltd., St. Helens, Lancs. T: St. Helens 4224. TA: Fibreglass, St. Helens.
Field Aircraft Services, Ltd., 72 Wigmore Street, London, W.1. T: Welbeck 7799. TA: Fieldair, Wesdo, London.
Finney Presses—see Fawcett, Preston and Co., Ltd.
Fireproof Tanks, Ltd., The Airport, Portsmouth. T: Portsmouth 62391/2/3/4. TA: Fireproof, Portsmouth.
Firestone Tyre and Rubber Co., Ltd., Great West Road, Brentford, Middx. T: Ealing 3456. TA: Firestone, Brentford.
Firth and John Brown, Ltd., Thos., P.O. Box 114, Atlas Works, Sheffield, 4. T: Sheffield 20081. TA: Atlas, Sheffield, 4.
Firth Cleveland Instruments—see Simmonds Aerocessories, Ltd.
Firth-Derihon Stampings, Ltd., The, Sheffield Road, Tinsley, Sheffield, 9. T: Sheffield 42051. TA: Derihon, Sheffield.
Firth-Vickers Stainless Steels, Ltd., Weedon Street, Tinsley, Sheffield, 9. T: Sheffield 42051. TA: Staybrite, Sheffield.
Fischer Bearings Co., Ltd., Upper Villiers Street, Wolverhampton. T: Wolverhampton 26101-8. TA: Hirey, Wolverhampton.
Fishers', 86/88 Wellington Street, Woolwich, London, S.E.18. T: Woolwich 1055. TA: Fishers', Woolwich.
Fison-Airwork, Ltd., Bourn, Nr. Cambridge. T: Madingley 314/355. TA: Fisair, Cambridge.
Flather, Ltd., W. T., Standard Steel Works, Tinsley, Sheffield, 9. T: Sheffield 41152. TA: Flather, Phone, Sheffield.
Flexello Castors and Wheels, Ltd., Slough, Bucks. T: Slough 24121. TA: Flexello, Slough.
Flexibox, Ltd., Nash Road, Trafford Park, Manchester 17. T: Trafford Park 1477. TA: Flexibox, Manchester, Telex.
Flight Equipment and Engineering, Ltd., 163/169 Brompton Road, London, S.W.3. T: Kensington 3698. TA: Flitequip.
Flight Refuelling, Ltd., Tarrant Rushton, Blandford, Dorset. T: Blandford 501. TA: Refuelling, Blandford.
Flint, Ltd., Howard, 18 Grosvenor Street, London, W.1. T: Mayfair 3282.
Foldex, Ltd., 45 Mitchell Street, London, E.C.1. T: Clerkenwell 0711. TA: Foldexlon, Cent.
Folland Aircraft, Ltd., Hamble, Southampton, Hampshire. T: Hamble 3191 (13 lines). TA: Follair, Hamble.
Fothergill and Harvey (Sales), Ltd., Harvester House, Peter Street, Manchester, 2. T: Blackfriars 3232. TA: Harvester, Manchester.
Fox and Co., Ltd., Samuel, Stocksbridge Works, nr. Sheffield. T: Sheffield 40871. TA: Fox, Deepcar, Telex.
Frankenstein and Sons (Manchester), Ltd., P., Victoria Rubber Works, Newton Heath, Manchester, 10. T: Failsworth 1166. TA: Proofing, Manchester.
French and Sons, Ltd., Thomas, Chester Road Mills, Manchester 15. T: Blackfriars 1887. TA: Rufflette, Manchester.

G.Q. Parachute Co., Ltd., Stadium Works, Portugal Road, Woking, Surrey. T: Woking 2277. TA: Parachutes, Woking.
Garringtons, Ltd., Newton Works, Bromsgrove, Worcs. T: Bromsgrove 2621. TA: Garrington, Phone, Bromsgrove.
Gear Grinding Co., Ltd., The, Cranmore Boulevard, Shirley, Solihull, Warwickshire. T: Shirley 2231. TA: Orcutt, Birmingham.
General Air Training, Ltd., 14 Woodlands Parade, High Street, Watford, Herts. T: Gadebrook 2089 and 2998.
General Electric Co., Ltd., The, Magnet House, Kingsway, London, W.C.2. T: Temple Bar 8000 (Ex. 218 or 321). TA: Electricity, Westcent, London.

General Fire Appliance Co., Ltd., 3 George Street, Croydon, Surrey. T: Croydon 2273. TA: Firgenap.

Girling, Ltd., Kings Road, Tyseley, Birmingham 11. T: Acocks Green 3371. TA: Girling, Birmingham.

Gloster Aircraft Co., Ltd., and Gloster Technical Developments, Gloucester. T: Gloucester 67011. TA: Glosaircra, Gloucester.

Gloster Engineering (Cheltenham), Ltd., 30-31 St. Paul's Street North, Cheltenham. Glos. T: Cheltenham 54799.

Godden (Cheltenham), Ltd., M. H., and M. H. Godden (Mouldings), Ltd., Bouncers Lane, Prestbury, Cheltenham. T: Cheltenham 7202/3.

Godfrey and Partners, Ltd., Sir George, Hampton Road West, Hanworth, Middx. T: Feltham 3291-7. TA: Godfrepart, London.

Goodmans Industries, Ltd., Axiom Works, Lancelot Road, Wembley, Middx. T: Wembley 1200 (8 lines). TA: Goodaxiom, Wembley, England.

Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The, Wolverhampton, Staffordshire. T: Wolverhampton 22321. TA: Gotyruco, Wolverhampton.

Goulder and Sons, Ltd., J., Kirkheaton, Huddersfield. T: Huddersfield 5252. TA: Monarch, Kirkheaton

Graseby Instruments, Ltd., Kingston By-pass Road, Tolworth, Surrey. T: Elmbridge 5742/3.

Graviner Manufacturing Co., Ltd., Poyle Mill Works, Colnbrook, Bucks. T: Colnbrook 2345 (6 lines). TA: Crashfires, Colnbrook.

Guest, Keen and Nettlefolds (Midlands), Ltd., Box No. 24, Heath Street, Birmingham 18. T: Smethwick 1441. TA: Nettlefolds, Birmingham 18.

H.M.I. (Engineering), Ltd., 466/490, Edgware Road, London, W.2. T: Paddington 0022

Habershon and Sons, Ltd., J. J., Holmes Mills, Rotherham. T: Rotherham 2081. TA: Habershon, Sons, Rotherham.

Hadfields, Ltd., East Hecla Works, Sheffield 9. T: Sheffield 41001. TA: Hadfield, Sheffield.

Hairlok Co., Ltd., The, Magna Works, Kathie Road, Bedford. T: Bedford 4271. TA: Bedford 4271.

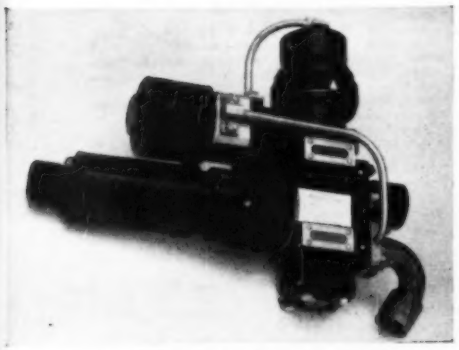
Hall and Hall, Ltd., Oldfield Works, Hampton, Middlesex. T: Molesey 2180. TA: Hallite, Hampton, Middx.

Hall and Sons (Bristol and London), Ltd., John, 1/5 St. Pancras Way, London, N.W.1. T: Euston 2262. TA: John Hall, London.

Handley Page, Ltd., Cricklewood, London, N.W.2. T: Gladstone 8000. TA: Hydrophid, Crickle.

Hants and Sussex Aviation, Ltd., The Airport, Portsmouth. T: Portsmouth 73947. TA: Portsmouth 73947.

Hard Aluminium Surfaces, Ltd., 38 Mair Street, Glasgow, S.W.1. T: Ibrox 2544.



Hymatic Engineering Co.: anti-g valve.

Hardy Spicer, Ltd., Birch Road, Witton, Birmingham 6. T: Birchfields 4504-9. TA: Autojoints, Birmingham.

Harley Aircraft Landing Lamps, Paxton Hill, St. Neots, Hunts. T: St. Neots 230-231. TA: Harley, St. Neots.

Harringay Photo Supplies, 423 Green Lanes, London, N.4. T: Mountview 5241/2.

Harvey and Co. (London), Ltd., G. A., Woolwich Road, London, S.E.7. T: Greenwich 3232. TA: Cheaper, London, S.E.7.

Headland Engineering Developments, Ltd., 38 Gartree Street, Leicester. T: Leicester 27782.

Heckford, Ltd., Arthur E., Frederick Street and Regent Street, Birmingham 1. T: Central (Birmingham) 2148. TA: Hecnum, Birmingham.

Heenan and Froude, Ltd., Worcester Engineering Works, Worcester. T: Worcester 3461 (10 lines). TA: Heenan, Worcester.

Helicopter Sales, Ltd., 14 Woodlands Parade, High Street, Watford, Herts. T: Gadebrook 2089 and 2998. TA: Helicopters, Watford.

Hellermann, Ltd., Gatwick Road, Crawley, Sussex. T: Crawley 2000/1/2/3/4. TA: Hellermann, Crawley.

Henderson Safety Tank Co., Ltd., The, 2 Elstree Way, Boreham Wood, Herts. T: Elstree 1758. TA: Hencorite, Boreham Wood.

Hendrey Relays, Ltd., 392 Bath Road, Slough. T: Burnham 609/610.

Integral, Ltd., hydraulic power-pack.

Henley's Telegraph Works Co., Ltd., W. T., 51-53 Hatton Garden, London, E.C.1. T: Chancery 6822. TA: Henletel, Cent, London.

Henshall and Sons (Addlestone), Ltd., W., Abbott Close, Oyster Lane, Byfleet, Surrey. T: Byfleet 2227-8. TA: Hentone.

Hepworth and Grandage, Ltd., St. John's Works, Bradford 4. T: Bradford 29595. TA: Rings, Bradford.

Hercules Engineering Co., Ltd., The, Worton Road, Isleworth, Middlesex. T: Hounslow 3043 and 3093.

Heston Aircraft and Associated Engineers, Ltd., The, Heston Airport, Hounslow, Middx. T: Hayes 3844. TA: Hestairco, Phone, Hounslow.

Hickman, Ltd., North Circular Road, London, N.W.2. T: Gladstone 6262. TA: Shopfronts, Crickle, London.

High Duty Alloys, Ltd., Slough, Buckinghamshire. T: Slough 23901. TA: Alloys, Slough.

High-Pressure Components, Ltd., Sunflex Works, Colham Mill Road, West Drayton, Middx. T: West Drayton 2226/7. TA: Gyponent, West Drayton.

Hines (Engineers), Ltd., Edward, Griffin Engineering Works, St. Margaret's Street, Norwich. T: Norwich 24281/2.

Hobson, Ltd., H. M., Hobson Works, Fordhouses, Wolverhampton, Staffs. T: Fordhouses 2266. TA: Accuracy, Phone, Wolverhampton.

Honeywell Controls, Ltd., Ruislip Road East, Greenford, Middlesex. T: Waxlow 2333. TA: Minnreg, Greenford.

Hooper and Co. (Coachbuilders), Ltd., Western Avenue, Acton, London, W.3. T: Acorn 0137. TA: Sociable, London.

Hordern Richmond (Sales), Ltd., Hy-du-lignum Works, Haddenham, Aylesbury, Bucks. T: Aylesbury 1100-2. TA: Winstix, Aylesbury, Bucks.

Houchin, Ltd., Garford Works, Chart Road, Ashford, Kent. T: Ashford 1538.

Hughes-Johnson Stampings, Ltd., The, Langley Green, Birmingham. T: Broadwell 1361. TA: Engines, Langley.

Hunting Aerosurveys, Ltd., 6 Elstree Way, Boreham Wood, Herts. T: Elstree 2214. TA: Astereo, Boreham Wood. CA: Astereo, London.

Hunting Aircraft, Ltd., The Airport, Luton, Beds. T: Luton 6060 and 4331. TA: Pergull, Luton.

Hunting-Clan Air Transport, Ltd., London Airport. T: Skyport 4111. TA: Huntavia, London.

Hunting Mhoglas, Ltd., The Airport, Luton, Beds. T: Luton 6060. TA: Pergull, Luton.

Hymatic Engineering Co., Ltd., The, Glover Street, Redditch, Worcs. T: Redditch 3621. TA: Hymatic, Redditch.

I.V. Pressure Controllers, Ltd., Atlas House, 683 London Road, Isleworth, Middlesex. T: Hounslow 7273/4/5. TA: Ivee Press, Hounslow.

Ilford, Ltd., Ilford, Essex. T: Ilford 3000. TA: Plates, Ilford.

Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. T: Waterloo 3333. TA: Iliffepres, Sedist, London.

Imperial Chemical Industries, Ltd., Imperial Chemical House, Millbank, London, S.W.1. T: Victoria 4444. TA: Impkemix, Telex, London.

Imperial Chemical Industries, Ltd., Leathercloth Division, Newton Works, Hyde, Cheshire. T: Hyde 2651. TA: Rexine, Hyde.

Imperial Chemical Industries, Ltd., Metals Division, Kynoch Works, Witton, Birmingham 6. T: Birchfields 4848. TA: Icimetal, Telex, Birmingham.

Imperial Chemical Industries, Ltd., Plastics Division, Black Fan Road, Welwyn Garden City, Herts. T: Welwyn Garden 3400. TA: Iciplast, Telex, Welwyn Garden City.

Integral, Ltd., Birmingham Road, Wolverhampton. T: Wolverhampton 24984. TA: Integral, Wolverhampton.

International Aeradio, Ltd., 40 Park Street, London, W.1. T: Hyde Park 5024. TA: Intaerio, London.

Irano Products, Ltd., Britannic House, Finsbury Circus, London, E.C.2. T: National 1200. TA: Iranolin, Telex, London.

Irish Air Charter, Ltd., 62 Merrion Square, Dublin. T: Dublin 62791. TA: Aircharter, Dublin.

Irving Air Chute of Great Britain, Ltd., Icknield Way, Letchworth, Herts. T: Letchworth 888. TA: Irving, Letchworth.

Irwin and Partners, Ltd., E. G., 2 Princes Row, Buckingham Palace Road, London, S.W.1. T: Tate Gallery 9393. TA: Trigmetric, Sowest, London.

Iso-Speedic Co., Ltd. ,The, Charles Street, Warwick. T: Warwick 1034/5/6. TA: Isospeedic, Warwick.

Isopad, Ltd., Barnet By-Pass, Boreham Wood, Herts. T: Elstree 2817/8/9/20. TA: Isopad, Borehamwood.

Jablo Plastics Industries, Ltd., and Jablo Propellers, Ltd., Mill Lane, Waddon, Croydon, Surrey. T: Croydon 2201. TA: Jablo, Croydon.

Jameson, Ltd., J. L. West Street, Ewell, Surrey. T. Ewell 4747-51. TA: Jameson, Ewell.

Jenks Brothers, Ltd., Britool Works, Fourth Avenue, Bushbury, Wolverhampton. T: Wolverhampton 31281. TA: Jenbro.

Jessop and Sons, Ltd., William, Brightside Works, Sheffield 9. T: 41352. TA: Jessop, Sheffield 9.

Jig Design and Engineering, Co., Vale Road, Windsor, Berks. T: Windsor 2171.

K.L.G. Aviation Products, Putney Vale, London, S.W.15. T: Putney 8111. TA: Kaelgee, Wesphone, London.

Kane, Ltd., Douglas, 5 New Quebec Street, London, W.1. T: Paddington 6364. TA: Dekatool, London.

Kautex, Ltd., Elstree Way, Elstree, Herts. T: Elstree 1777/8/9. TA: Kautex, Borehamwood.

Kaylee Transfers, Ltd., New Tythe Street, Nottingham. T: Long Eaton 692.

Kayser, Ellison and Co., Ltd., Carlisle Steel Works, Carlisle Street, Sheffield 4. T: Sheffield 22124. TA: Kayser, Sheffield 4.

Keim Engineering, Ltd., Hanworth Trading Estate, Hampton Road West, Hanworth, Feltham, Middlesex. T: Feltham 4881. TA: Dosenkeim, Feltham.

Kelston Engineering Co., Ltd., Kitchener Road, Lodge Causeway, Fishponds, Bristol. T: Bristol 65-1201/2. TA: Kelenco, Bristol.

Kelvin and Hughes, Ltd., Husun Works, New North Road, Barkingside, Ilford, Essex. T: Hainault 2601. TA: Husun, Barkingside.

Kelvin and Hughes (Aviation), Ltd., Winchester Road, Basingstoke, Hants. T: Basingstoke 690. TA: Kelbaird.

Kenilworth Manufacturing Co., Ltd., The, Hermetite Works, West Drayton, Middx. T: West Drayton 3731. TA: Usefulness, West Drayton.

Kent Alloys, Ltd., Temple Manor Works, Rochester, Kent. T: Strood 7674-7. TA: Alloys, Rochester.

Kent, Ltd., George, Biscot Road Works, Luton, Beds. T: Luton 2440. TA: Kents, Telex, Luton.

Ketay, Ltd., Eddes House, Eastern Avenue West, Romford, Essex. T: Seven Kings 6050. TA: Ketay, Romford.

Kidde Co., Ltd., The Walter, Belvue Road, Northolt, Middlesex. T: Waxlow 1601. TA: Luxtector, London.

Kigass, Ltd., 31 Regent Grove, Leamington Spa, Warwicks. T: Leamington Spa 2480. TA: Kigass, Leamington.

Kilfrost, Ltd.—see T.K.S. (De-Icing), Ltd.

King Aircraft Corporation, Cameron Street, Hillington, Glasgow, S.W.2. T: Halfway 4571. TA: Aircraft, Glasgow.

Kingston Instrument Co., Ltd., Cox Lane, Chessington, Surrey. T: Lower Hook 1001.

Kodak, Ltd., Kodak House, Kingsway, London, W.C.2. T: Holborn 7841. TA: Kodak, Westcent, London.

Lacy-Hulbert and Co., Ltd., Boreas Works, Beddington, Nr. Croydon, Surrey. T: Croydon 5504/7. TA: Percussive, Croydon.

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Laporte Chemicals, Ltd., Kingsway Works, Kingsway, Luton, Bedfordshire. T: Luton 4390. TA: Laporte, Luton.

Latex Upholstery, Ltd., 41 Lonsdale Road, London, W.11. T: Bayswater 6262-6.

Lawrence, Ltd., J. W., Crusader Works, Abbey Lane, Leicester. T: Leicester 62441/2/3. TA: Crusader, Leicester.

Laycock Engineering, Ltd., Victoria Works, Millhouses, Sheffield 8. T: Sheffield 74411. TA: Invention, Sheffield.

Lec Refrigeration, Ltd., Bognor Regis, Sussex. T: Bognor Regis 2201. TA: Telex 8687.

Lewin Road Sweepers, Ltd., Victoria Works, Hill Top, West Bromwich, Staffs. T: Wednesbury 0243. TA: Brockhouse, West Bromwich.

Lewis, D., Ltd., 124 Gt. Portland Street, London, W.1. T: Museum 4314. TA: Aviakit, Wesdo, London.

Leytonstone Jig and Tool Co., Ltd., Leytool Works, High Road, Leyton, London, E.10. T: Leytonstone 5022. TA: Leytool, London.

Light Soldering Developments, Ltd., 106 George Street, Croydon, Surrey. T: Croydon 8589. TA: Litesold, Croydon.

Lockheed Hydraulic Brake Co., Ltd., Tachbrook Road, Leamington Spa, Warwicks. T: Leamington Spa 2700. TA: Autoducts.

Lodge Plugs, Ltd., St. Peter's Road, Rugby, Warwicks. T: Rugby 2076. TA: Lodge, Rugby.

Long and Hambly, Ltd., Slater Street, High Wycombe, Bucks. T: High Wycombe 4041. TA: Longhamb, High Wycombe.

London Production Tools, Ltd., Cobbold Estate, Cobbold Road, Willesden, London, N.W.10. T: Willesden 0023/4.

London School of Air Navigation, Ltd., The, 33 Ovington Square, Knightsbridge, London, S.W.3. T: Kensington 8221.

Low Moor Alloy Steelworks, Ltd., Low Moor, Bradford, Yorkshire. T: Bradford 77331. TA: Steeloy, Low Moor.

Low Moor Fine Steels, Ltd., The Steelworks, Low Moor, Bradford, Yorks. T: Bradford 77336. TA: Steeloy, Low Moor.

Lucas, Ltd., Joseph, Great King Street, Birmingham 19. T: Northern 5252. TA: Lucas, Telex, Birmingham.

Lucas (Gas Turbine Equipment), Ltd., Joseph, Shaftmoor Lane, Birmingham, 28, Warwickshire. T: Springfield 3232. TA: Luset.

M.H.H. Engineering Co., Ltd., Gosden Common, Bramley, Guildford, Surrey. T: Bramley 2248.

M.L. Aviation Co., Ltd., White Waltham, Maidenhead, Berks. T: Littlewick Green 248. TA: Emelair, White Waltham.

Macresdy's Metal Co., Ltd., Usaspead Corner, Pentonville Road, London, N.1. T: Terminus 7060. TA: Usaspead, London, Telex.

McAlpine and Sons, Ltd., Sir Robert, Aviation Division, Luton Airport, Luton, Bedfordshire. T: Luton 8073.

McMichael Radio, Ltd., Wexham Road, Slough, Bucks. T: Slough 24541. TA: Radiether, Slough.

Magnesium Elektron, Ltd., P.O. Box 6, Clifton Junction, Swinton, Manchester. T: Swinton 2511. TA: Magneselek, Phone, Manchester.

Magnus Chemical Co., Ltd., 66 Bolsover Street, London, W.1. T: Euston 5387/8/9. TA: Magchem, Wesdo, London.

Mallock-Armstrong Co., The, 204 High Street, Guildford, Surrey. T: Guildford 66488.

Manchester Oil Refinery (Sales), Ltd., 76 Jermyn Street, London, S.W.1. T: Whitehall 8411. TA: Trafordil, London, Telex.

Marconi Instruments, Ltd., Longacres, St. Albans, Herts. T: St. Albans 56161. TA: Measurtest, St. Albans.

Marconi's Wireless Telegraph Co., Ltd., New Street, Chelmsford, Essex. T: Chelmsford 3221. TA: Expanse, Chelmsford.

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Marston Excelsior, Ltd., Wobaston Road, Fordhouses, Wolverhampton. T: Fordhouses 3361. TA: Icimarex, Wolverhampton.

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Mavitta Drafting Machines, Ltd., Highlands Road, Shirley, Solihull, Warwicks. T: Solihull 2231/2. TA: Mavitta, B'ham.

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Mechanism, Ltd., 6a George Street, Croydon, Surrey. T: Croydon 3426-9. TA: Gyromec, Croydon.

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Meridian Airmaps, Ltd., Shoreham Airport, Sussex. T: Shoreham-by-Sea 2366.

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Midland Silicones, Ltd., 68 Knightsbridge, London, S.W.1. T: Knightsbridge 7801. TA: Midsil, Wesphone, London.

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Miles Structural Plastics, Ltd., Regal Works, Penhill Road, Lancing, Sussex. T: 2301/7.

Miller Aviation, Ltd., Adastral House, Nutfield, Redhill, Surrey. T: Redhill 5050. TA: Milspares, Redhill.

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Modern Industrial Finishes, Ltd., Thames Chemical Works, Lower Road, Northfleet, Gravesend, Kent. T: Greenhithe 3171. TA: Modfin, Gravesend.

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Mond Nickel Co., Ltd., The, Thames House, Millbank, Westminster, S.W.1. T: Victoria 3888. TA: Nictatio, Telex, London.

Morfax, Ltd., Willow Lane, Mitcham, Surrey. T: Mitcham 4525.

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Mullard, Ltd., Mullard House, Torrington Place, London, W.C.1. T: Langham 6633. TA: Mullectron, London.

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Napier and Son, Ltd., D., 211 The Vale, London, W.3. T: Shepherds Bush 1220. TA: Moneyer, Telex, London.

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Newmark, Ltd., Louis, Prefect Works, Purley Way, Croydon, Surrey. T: Croydon 5571. TA: Newmark, Croydon.

Newton and Co., H. T., Gatwick Airport, Horley, Surrey. T: Horley 3613 and Livingstone 8811. TA: Newtonair.

Newton and Co., Ltd., L. H., Nechels, Birmingham 7. T: East 1551. TA: Bolanut, Telex, Birmingham.

Newton Brothers (Derby), Ltd., Alfreton Road, Derby. T: Derby 47676 (4 lines). TA: Dynamo, Derby.

Normalair, Ltd., Yeovil, Somerset. T: Yeovil 1100. TA: Normalair, Yeovil.

Northern Aluminium Co., Ltd., Bush House, Aldwych, London, W.C.2. T: Temple Bar 8430. TA: Noraluco, Estrand, London.

North West Machine Design Co., Ltd., 177 Kenton Road, Kenton, Middx. T: Wordsworth 0301.

Oddie, Bradbury and Cull, Ltd., Portswood Road, Southampton, Hants. T: Southampton 55883. TA: Fasteners, Southampton.

Oldham and Son., Ltd., Denton, Manchester. T: Denton 2431. TA: Oldhams, Denton, Manchester.

Omes, Ltd., Beverley Works, Barnes, London, S.W.13. T: Prospect 2291. TA: Omesheatly, Put, London.

Optical Measuring Tools, Ltd., Oldfield House, 142 Bridge Road, Maidenhead, Berks. T: Maidenhead 3704-5-6. TA: Optool, Maidenhead.

Page Engineering Co., Page Works, Forge Lane, Green Street, Sunbury on Thames, Middlesex. T: Sunbury on Thames 2642.

Palmer Aero Products, Ltd., Penfold Street, Edgware Road, London, N.W.8 T: Paddington 8822.

Pandect Instrument Laboratories, Ltd., Wellington Road, High Wycombe, Bucks. T: High Wycombe 2150.

Park Gate Iron and Steel Co., Ltd., The, Park Gate Works, P.O. Box No. 23, Rotherham. T: Rotherham 2141 TA: Yorkshire, Parkgate, Yorks.

Park, Ltd., R. and J., Dominion House, Thames Road, Chiswick, London, W.4. T: Chiswick 7761. TA: Parkdomin, Chisk.

Parman Aircraft Supplies, Ltd., Parman House, Balcombe Road, Horley, Surrey. T: Horley 4344. TA: Parmanair, Horley.

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Parsons and Co., Ltd., S., St. George's Ironworks, Young Street, Bradford, Yorks. T: Bradford 45494. TA: Parweigh 8, Bradford.

Pearson Brothers (Engineers), Ltd., Loudoun Road Mews, London, N.W.8. T: Maida Vale 1528.

Pegasus Engineering, Ltd., Edinburgh Way, Harlow, Essex. T: Harlow 25527. TA: Harlow 22527.

Petbow, Ltd., Sandwich, Kent. T: Sandwich 3311. TA: Petbowld, Sandwich.

Peto and Radford, 137 Victoria Street, London, S.W.1. T: Tate Gallery 9212. TA: Storage, Sowest, London.

Phillips and White, Ltd., 61 Queen's Gardens, London, W.2. T: Ambassador 8651 and 2764. TA: Gyrair, London.

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Plessey Co., Ltd., The, Vicarage Lane, Ilford, Essex. T: Ilford 3040. TA: Plessey, Telex, Ilford.

Portsmouth Aviation, Ltd., The Airport, Portsmouth, Hants. T: Portsmouth 62251/5. TA: Balmurlux, Portsmouth.

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Pulsometer Engineering Co., Ltd., The, Nine Elms Ironworks, Reading, Berks. T: Reading 67182/3/4. TA: Pulsometer, Reading.

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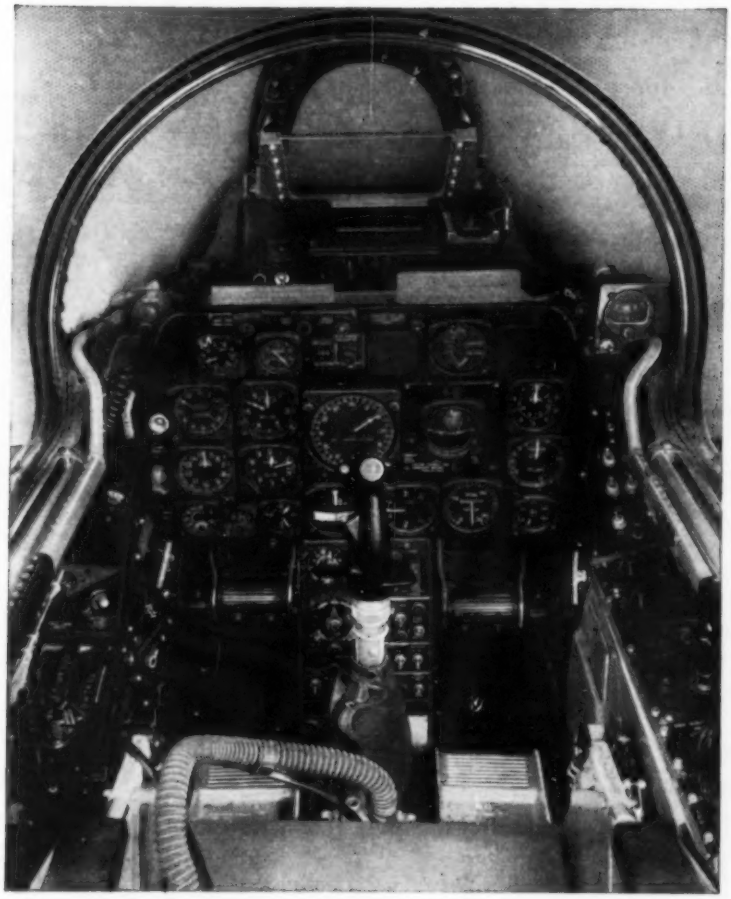

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Ratcliffe (Rochdale), Ltd., F. S., Crawford Spring Works, Norman Road, Rochdale, Lancs. T: Rochdale 4692. TA: Recoil, Rochdale.
Rawlplug Co., Ltd., The, Rawlplug House, Cromwell Road, London, S.W.7. T: Fremantle 8111. TA: Rawlplug, Southkens.
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Regent Oil Co., Ltd., 117 Park Street, London, W.1. T: Mayfair 8474. TA: Biregent.
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Renold Chains, Ltd., Renold House, Wythenshawe, Manchester. T: Gatley 5221. TA: Driving, Telex, Manchester.
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Reynolds T.I. Aluminium, Ltd., Redfern Road, Tyseley, Birmingham 11, and 10 Buckingham Place, London, S.W.1. T: Acocks Green 4211 and Victoria 0902. TA: Timinium, Birmingham/London.
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Robinson and Co. (Gillingham), Ltd., L., London Chambers, Gillingham, Kent. T: Gillingham 5282.
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Rollet and Co., Ltd., H., 6 Chesham Place, London, S.W.1. T: Sloane 3463. TA: Knonferous, Wesphone, London.
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Royce Electric Furnaces, Ltd., Sir Richard's Bridge, Walton-on-Thames, Surrey. T: Walton-on-Thames 2577/8.
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Royston Instruments, Ltd., Hanworth Lane, Chertsey, Surrey. T: Chertsey 3431.
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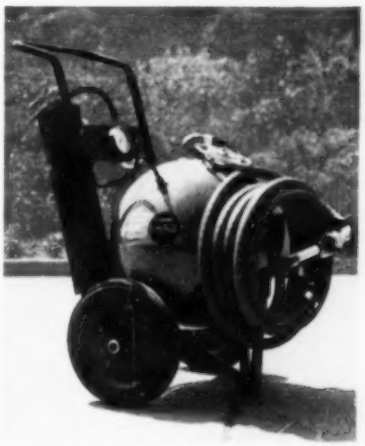
Simmons and Hawker, Ltd., Southdown Works, Point Pleasant, Wandsworth, S.W.18. T: Vandyke 4401/8. TA: Simmonic, Put, London.
Skefco Ball Bearing Co., Ltd., The, Leagrave Road, Luton, Beds. T: Luton 5700. TA: Skefco, Telex, Luton.
Skyhi, Ltd., Skyhi Works, Worton Road, Isleworth, Middx. T: Hounslow 2211/2/3. TA: Skyhijack, Phone, London.
Sky-Lines Aircraft Components, Ltd., 13a London Road, Camberley, Surrey. T: Camberley 1326. TA: Skyaero.
Skyways, Ltd., Stansted Airport, Essex. T: Bishop's Stortford 1641. TA: Skyways, Ops, Stansted.
Smith's Aircraft Instruments, Ltd., Cricklewood, London, N.W.2. T: Gladstone 3333. TA: Airspeed, London, Telex.
Smith's Stamping Works (Coventry), Ltd., Ribble Road Works, Humber Avenue, Coventry. T: Coventry 3151. TA: Force, Coventry.
Solartron Electronic Group, Ltd., The, Solartron Works, Queen's Road, Thames Ditton, Surrey. T: Emberbrook 5522. TA: Solartron, Thames Ditton.
Soundrite, Ltd., 82/83 New Bond Street, London, W.1. T: Hyde Park 1138. TA: Soundrite, London.
Southern Forge, Ltd., Meadfield Road, Langley, Bucks. T: Langley (Bucks) 301. TA: Forgings, Slough.
Southern Instruments, Ltd., Frimley Road, Camberley, Surrey. T: Camberley 2230. TA: Minrak, Camberley.
Spa Guilds, Ltd., St. James's Square, Cheltenham, Glos. T: Cheltenham 53312.

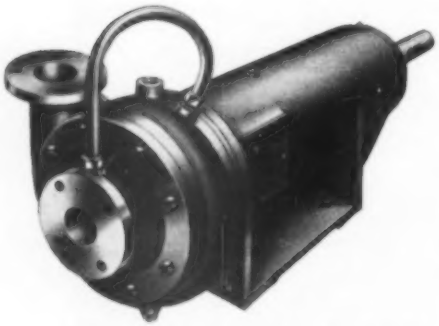


Tecalemit-Foamite "Fireball" extinguisher (dry chemical) for petrol and electrical fires.

Sparklets, Ltd., Queen Street, Tottenham, London, N.17. T: Tottenham 0881. TA: Sparklets, Norphone, London.
SPE Co., Ltd., Edinburgh Avenue, Trading Estate, Slough, Bucks. T: Slough 23277. TA: Priming, Slough.
Specto, Ltd., Vale Road, Windsor, Berks. T: Windsor 1241. TA: Specto, Windsor.
Spencer Moulton and Co., Ltd., George, Melksham, Wilts. T: Melksham 3101. TA: Rubber, Melksham.
Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. T: Ealing 6771. TA: Sperigyco, Wesphone, London.
Spring Washers, Ltd., Wobaston Road, Fordhouses, Wolverhampton. T: Fordhouses 2176/7. TA: Soaring, Wolton.
Stainless Steel Wire Co., Ltd., The Barracks, Langsett Road, Sheffield 6. T: Sheffield 344241/2. TA: Finewyre, Sheffield.
Standard Telephones and Cables, Ltd., Connaught House, 63 Aldwych, London, W.C.2. T: Holborn 8765. TA: Relay, Telex, London.
Steel, Peech and Tozer, The United Steel Companies, Ltd., 17 Westbourne Road, Sheffield 10. T: Sheffield 41011. TA: Phoenix, Sheffield.
Steel Stampings, Ltd., Cookley, nr. Kidderminster, Worcs. T: Wolverley 266. TA: Stampings, Cookley.
Sterling Metals, Ltd., Gipsy Lane, Nuneaton. T: Nuneaton 4221. TA: Stermet, Phone, Nuneaton.
Stewart Aeronautical Supply Co., Ltd., Adastral House, Nutfield, Redhill, Surrey. T: Redhill 5050. TA: Sasco, Redhill.
Stone and Co. (Charlton), Ltd., J., Woolwich Road, Charlton, S.E.7. T: Greenwich 3277. TA: Tostones, London, S.E.7.
Stone and Co. (Deptford), Ltd., J., Arklow Road, London, S.E.14. T: Tideway 1202. TA: Tostones, Telex, London.
Straight-Lite Reflectors, Ltd., 36 Eden Grove, Holloway, London, N.7. T: North 4296/7.
Stream-Line Filters, Ltd., Ingate Place, London, S.W.8. T: Macaulay 1011/2/3. TA: Edgefilt, Claproad, London.

ANCILLARY INDUSTRY 1958...

Stuart (London), Ltd., Robert, Ascham Street, Kentish Town, London, N.5. T: Gulliver 6141.
Suntex Safety Glass Industries, Ltd., Thorney Lane, Iver, Bucks. T: Iver 11-12. TA: Suntex, Iver.
Super Oil Seals and Gaskets, Ltd., Birmingham Factory Centre, Kings Norton, Birmingham, 30. T: Kings Norton 2041-7. TA: Oilseal Birmingham.
Surridge's Patents, Ltd., New Works, Croydon Road, Elmers End, Beckenham, Kent. T: Beckenham 0168. TA: Surridge, Beckenham.
Sutton, R. W. (Consultants), Ltd., 7 Lansdowne Place, Cheltenham, Glos. T: Cheltenham 5811 and 53808.



Saunders Valve Co., Ltd., "Safran" H.T.P. pump (230 g.p.m. at 2,700-3,000 r.p.m.).

T.K.S. (Aircraft De-Icing), Ltd., Drayton House, Gordon Street, London, W.C.1. T: Euston 4650. TA: Deicing, Phone, London.
Talbot Stead Tube Co., Ltd., Green Lane, Walsall, Staffs. T: Walsall 4186. TA: Telex 3387.
Tecalemit, Ltd., Marsh Mills, Plymouth, Devon. T: Plymouth 62844. TA: Tecalemit, Plymouth.
Technical Platings, Ltd., Teddington, Middx. T: Molesey 4381-3.
Technograph Electronic Products, Ltd., and Technograph Printed Circuits, Ltd., 32 Shaftesbury Avenue, London, W.1, and 207 Fleet Road, Fleet, Hants. T: Gerrard 4532 and Fleet 1500.
Teddington Aircraft Controls, Ltd., Cefn Coed, Merthyr Tydfil, South Wales. T: Merthyr Tydfil 666. TA: Precision, Merthyr Tydfil.
Teleflex Products, Ltd., Christopher Martin Road, Basildon, Essex. T: Basildon 22861. TA: Teleflex, Phone, Basildon.
Telegraph Construction and Maintenance Co., Ltd., The, Mercury House, Theobalds Road, London, W.C.1. T: Holborn 8711. TA: Telcon, London, Telex.
Terry and Sons, Ltd., Herbert, Redditch, Worcestershire. T: Redditch 61. TA: Springs, Redditch.
Texas Instruments, Ltd., Dallas Road, Bedford. T: Bedford 68051. TA: Texinlim, Bedford.
Thermal Control Co., Ltd., Marine Works, Sackville Road, Hove, Sussex. T: Hove 34081 and Hove 35929.
Thermionic Products, Ltd., Hythe, Southampton. T: Hythe (Southampton) 3265. TA: Technico, Hythe, Hants.
Thermo-Plastics, Ltd., Luton Road Works, Dunstable, Beds. T: Dunstable 1444. TA: Thermoplastics, Dunstable.
Thompson Bros. (Bilston), Ltd., Bradley Engineering Works, Bilston, Staffs. T: Bilston 41264. TA: Thompbros, Bilston.
Thorn Electrical Industries, Ltd., 146 Great Cambridge Road, Enfield, Middlesex. T: Enfield 5360. TA: Fergurad, Phone, London.
Thornycroft and Co., Ltd., John I., Thornycroft House, Smith Square, London, S.W.1. T: Abbey 8000. TA: Thornycroft, Phone, London.
Tiltman Langley, Ltd., Redhill Aerodrome, Surrey. T: Nutfield Ridge 2232. TA: Airdel, Redhill.
Titanine, Ltd., Sheaveshill Avenue, Colindale, London, N.W.9. T: Colindale 8123. TA: Tetrafree, Hyde, London.
Torrington Co., Ltd., The, Torrington Avenue, Canley, Coventry. T: Coventry 74241/6. TA: Spokes, Coventry.
Transport Seating, Ltd., Western Works, Bromley Street, Birmingham 9. T: Victoria 1477 and 1326.
Travelair, Ltd., 115 Oxford Street, London, W.1. T: Gerrard 3382. TA: Equipair, Wesdo, London.
Triplex Safety Glass Co., Ltd., The, 1 Albemarle Street, Piccadilly, London, W.1. T: Hyde Park 8171. TA: Tripsaglas, Piccy, London.
Trist and Co., Ltd., Ronald, Bath Road, Slough, Bucks. T: Slough 25041. TA: Resvalar, Slough.
Tubes, Ltd., Rocky Lane, Aston, Birmingham, 6. T: Aston Cross 3030. TA: Cylinders, Birmingham.
Tucker Eyelet Co., Ltd., Geo., Walsall Road, Birmingham 22. T: Birchfields 4811 (9 lines). TA: Eyelets, Birmingham.
Tufnol, Ltd., Perry Barr, Birmingham 22B. T: Birchfields 4554. TA: Tufworks, Birmingham.
Tungum Co., Ltd., The, Cheltenham, Glos. T: Cheltenham 5856-7. TA: Tungum, Cheltenham.
Turner Brothers Asbestos Co., Ltd., Spotland, Rochdale. T: Rochdale 4221. TA: Turners, Rochdale.
Turner Electrical Instruments, Ltd., Ernest, Chiltern Works, High Wycombe, Bucks. T: High Wycombe 1301/2/3. TA: Gorgeous, High Wycombe.

Uhlhorn Bros., Ltd., 51-3 City Road, London, E.C.1. T: Clerkenwell 0145/9.
Ultra Electric, Ltd., Western Avenue, Acton, W.3. T: Acorn 3434. TA: Radwaves, Telex, London.

Vactric (Control Equipment), Ltd., Vactric House, Sloane Street, London, S.W.1. T: Sloane 9656. TA: Vactrify, Knights.
Valay Industries, Ltd., 186 Campden Hill Road, London, W.8. T: Park 8601. TA: Valaypro, Kens, London.
Vane and Co., A. H., Empire House, St. Martin's-le-Grand, London, E.C.1. T: Metropolitan 9201 and 9202. TA: Avants, Cent, London.
Van Moppes, L. M. and Sons (Diamond Tools), Ltd., Basingstoke, Hampshire. T: Basingstoke 1240. TA: Diatipt, Basingstoke.
Varley Dry Accumulators, Ltd., By-pass Road, Barking, Essex. T: Rippleway 3346/7/8.
Vaughan and Co., Ltd., Edgar, Legge Street, Birmingham 4. T: Birmingham, Aston Cross 2071-5. TA: Compete, Phone, Birmingham.
Venner Accumulators, Ltd., Kingston By-pass, New Malden, Surrey. T: Malden 2442. TA: Venulators, Phone, New Malden.
Venner, Ltd., Kingston By-pass, New Malden, Surrey. T: Malden 2442. TA: Cloxwiches, Phone, New Malden.
Vernons Industries, Ltd., Kirkby Trading Estate, Kirkby, Liverpool. T: Simonswood 3261. TA: Vernex, Liverpool.
Vinten, Ltd., W., 715 North Circular Road, London, N.W.2. T: Gladstone 6373-4-5. TA: Vintacinni-London.
Vokes, Ltd., Henley Park, Guildford, Surrey. T: Guildford 62861. TA: Vokesacess, Guildford, Telex.
Vosper, Ltd., P.O. Box 18, Portsmouth. T: Cosham 79481. TA: Repsov, Portsmouth.
Vulcan Products, Ltd., York House, 37 Queen Square, London, W.C.1. T: Chancery 6877. TA: Glossex, Westcent, London.

W.S. Electronics (Production), Ltd., Brunel Road, East Acton, London, W.3. T: Shepherds Bush 7601. TA: Seltric, Ealux, London.
Wakefield and Co., Ltd., C. C., 46 Grosvenor St., London, W.1. T: Mayfair 9232. TA: Cheery, Wesdo, London.
Wakefield-Dick, Industrial Oils, Ltd., 67 Grosvenor Street, London, W.1. T: Grosvenor 6050. TA: Dicotto, Phone, London.
Walker and Co., Ltd., James, Lion Works, Woking, Surrey. T: Woking 2432. TA: Lioncelle, Telex, Woking.
Walker (A.D.), Ltd., James, 15-17 Brunel Road, East Acton, London, W.3. T: Shepherds Bush 2332 and 6868.
Walter, A. J., Gatwick Airport, Horley, Surrey. T: Horley 1510, Ext. 105-6. TA: Cubeng, London.
Walterisation Co., Ltd., The Waddon Marsh, Purley Way, Croydon, Surrey. T: Croydon 2791. TA: Rustproof, Croydon.
Warden Aviation and Engineering Co., Old Warden Aerodrome, Biggleswade, Beds. T: Northill 288. TA: Oldwarden.
Waymouth Gauges and Instruments, Ltd., Station Road, Godalming, Surrey. T: Godalming 1330-1. TA: Wayco, Godalming.
Wayne Kerr Laboratories, Ltd., The, Roebuck Road, Chessington, Surrey. T: Lower Hook 1131. TA: Waynkerr, Chessington.
Wayne Tank and Pump Co., Ltd., Western Road, Bracknell, Berks. T: Bracknell 1600. TA: Waynoil, Bracknell, Telex.
Wellwinch Engineering, Ltd., Wellwinch Road, Sittingbourne, Kent. T: Sittingbourne 600-603. TA: Wellwinch, Sittingbourne.
Wellworthy, Ltd., Radial Works, Stanford Road, Lymington, Hampshire. T: Lymington 2231-8. TA: Wellworthy.
Western Manufacturing (Reading), Ltd., The Aerodrome, Woodley, Reading, Berks. T: Sonning 2351. TA: Hawk, Reading.
Westinghouse Brake and Signal Co., Ltd., 82 York Way, King's Cross, London, N.1. T: Terminus 6432. TA: Westinghouse, London, Telex.
Westland Aircraft, Ltd., Yeovil, Somerset. T: Yeovil 1100. TA: Aircraft, Yeovil.
Westminster Airways Servicing, Ltd., Priory Road, Hardway, Gosport, Hampshire. T: Gosport 88081-2-3. TA: Westminair, Gosport.
Westway Models, Ltd., 15/17 Brunel Road, East Acton, London, W.3. T: Shepherds Bush 7022. TA: Miniatures, Ealux, London.
Weyburn Engineering Co., Ltd., Elstead, Surrey. T: Elstead 2141. TA: Weyburn, Elstead.
Whitehouse Industries, Ltd., Ferrybridge, Knottingley, Yorkshire. T: Knottingley 2323. TA: Balbearing, Ferrybridge.
Whittemore (Aeradio), Ltd., A. J., Croydon Airport, Croydon, Surrey. T: Croydon 8396/7/8. TA: Aeradio, Croydon.
Wiggin and Co., Ltd., Henry, Wiggin St., Birmingham 16. T: Edgbaston 2245. TA: Wigaloy, Telex, Birmingham.
Willan, Ltd., G. L., Sussex Street, Sheffield 4. T: Sheffield 24211.
Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T: Gloucester 24021/2/3. TA: Compressor, Gloucester.
Williamson Manufacturing Co., Ltd., Litchfield Gardens, Willesden Green, London, N.W.10. T: Willesden 0073/75. TA: Kinetogram, London.
Wills Pressure Filled Joint Ring, Ltd., Salmon Parade, Bridgwater, Somerset. T: Bridgwater 4171-2. TA: Willseal, Bridgwater.
Wilmot Breeden, Ltd., Amington Road, Birmingham, 25. T: Acocks Green 3344. TA: Bumpers, Birmingham.
Wilson and Sons (London), Ltd., W., 114 Nightingale Road, London, W.22. T: Bowes Park 8431.
Woodside Die Sinking Co., Ltd., Aire Vale Works, Newlay, Leeds 13. T: Horsforth 4251/4.
Wynn and Co. (Aircraft), Ltd., E. D., Staverton Aerodrome, Gloucester. T: Churchdown 3264/5. TA: Wynn, Gloucester.

Xetal Products, Ltd., Speke Hall Road, Speke, Liverpool, 19. T: Hunts Cross 2078.

Y.S.C., Ltd., The, 45-47 Copeland Road, London, S.E.15. T: New Cross 6113. TA: Yessee, Peck, London.
Yorkshire Engineering Supplies, Ltd., Upper Wortley Road, Leeds, 12. T: Leeds 638234 and 638291. TA: Yes, Leeds, 12.
Young, A. W., 47 Mildenhall Road, Clapton, London, E.5. T: Amherst 6521.
Young, Ltd., James, 37/39 London Road, Bromley, Kent. T: Ravensbourne 3434/5/6/7/8.

Z and I Aero Services, Ltd., 14 South Wharf Road, London, W.2. T: Ambassador 0151/2. TA: Zaero, London.
Zwicky, Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks. T: Slough 21201. TA: Zwiklim, Slough.

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BRITISH MILITARY AIRCRAFT 1958

(INCLUDING RESEARCH AIRCRAFT AND CERTAIN MILITARY TYPES NOW OUT OF PRODUCTION)

Maker and Type	Main Duties	Span ft in	Length ft in	Power Unit(s) No.	Power Unit(s) Type	Power Unit(s) Total Power (note 1)	Max. gross wt lb	Wing loading lb sq ft	Armament (see note 2) Guns No. Cal. lb	Armament (see note 2) Bombs No. Wt. lb	Armament (see note 2) R.P.s or Missiles No. Wt. lb	Max. speed m.p.h.	Max. speed ft	Climb to ft	Climb min	Typical Range miles
Armstrong Whitworth																
Sea Hawk FGA.6	F.Strike	39 0	40 0	1	Nene	5,000+	n.r.	n.r.	4 20	2 500	8 60	600+	n.r.	n.r.	n.r.	n.r.
AW.660	Tt.	115 0	86 9	4	Dart	8,400	n.r.	n.r.	nil	nil	nil	300+	n.r.	n.r.	n.r.	n.r.
AW.661	Tt.	115 0	86 9	2	Tyne	10,630	n.r.	n.r.	nil	nil	nil	300+	n.r.	n.r.	n.r.	n.r.
Auster																
A.O.P.9	O.C.	36 5	23 8½	1	Bombardier 203	180	2,125	10.4	nil	nil	nil	127	—	i.r.c.∞	920 ft/min	240
Avro																
Shackleton MR.3	A.-S. R.	120 0	87 4	4	Griffon 67	9,800	n.r.	n.r.	2 20	various	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Vulcan B.1	B.	99 0	97 1	4	Olympus	52,000	n.r.	n.r.	nil	A.	nil	600+	n.r.	n.r.	n.r.	n.r.
Vulcan B.2	B.	111 0	n.r.	4	Olympus 200-series	68,000	n.r.	n.r.	nil	A.	S.O.B.	600+	n.r.	n.r.	n.r.	n.r.
Blackburn and General Aircraft																
Beverley C.1	Tt.	162 0	99 5	4	Centaurus 173	11,400	135,000	44	nil	nil	nil	242	8,000	7,500	10	1,200
B.107	Tt.	166 8	124 0	4	Tyne	22,100	175,000	—	nil	nil	nil	n.r.	25,000	n.r.	n.r.	n.r.
NA.39	Strike	n.r.	n.r.	2	Gyron Junior	n.r.	n.r.	n.r.	nil	A.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Bristol																
Britannia 253	Tt.	142 3	124 3	4	Proteus 255	17,780	180,000	86.9	nil	nil	nil	400+	25,000+	—	—	4,480
de Havilland																
Sea Vixen FAW.1	F.Strike	50 0	53 6	2	Avon	20,000+	n.r.	n.r.	nil	A.	4 Fsks.	700+	n.r.	n.r.	n.r.	n.r.
Sea Venom FAW.22	F.Strike	42 10	36 8	1	Ghost 105	5,300	15,800	55.2	4 20	—	8 60	576	s.l.	40,000	14	705
Vampire Trainer	T.	38 0	34 6	1	Goblin 35	3,500	11,680	44.7	4 20	opt.	8 25	538	s.l.	30,000	14	789
English Electric																
P.1B Lightning	F.	34 10	50 0	2	Avon	n.r.	n.r.	n.r.	2 30	?	2-4 Fsks	1,300+	n.r.	n.r.	n.r.	n.r.
Canberra B(I).8	B.I.	64 0	65 6	2	Avon	n.r.	n.r.	n.r.	4 20	A.	opt.	n.r.	n.r.	n.r.	n.r.	n.r.
Canberra PR.9	R.	68 0	66 8	2	Avon	20,000+	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Canberra U.10	D.	64 0	65 6	2	Avon	n.r.	n.r.	n.r.	nil	nil	nil	600+	n.r.	n.r.	n.r.	n.r.
Fairey																
Gannet AS.4 and T.5	A.-S. T.	54 4	43 0	1	Double Mamba	n.r.	n.r.	n.r.	nil	2 1,000	16 60	n.r.	n.r.	n.r.	n.r.	n.r.
Gannet AEW.3	E.W.	54 6	44 0	1	Double Mamba	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
F.D.2	R'ch.	26 10	51 7	1	Avon	10,000+	n.r.	n.r.	nil	nil	nil	1,132+	38,000	n.r.	n.r.	n.r.
Folland																
Gnat Mk 1	F.B.	22 2	29 9	1	Orpheus	4,850	8,600	63	2 30	2 1,000	18 R.P.	M=0.98	—	45,000	5	920
Gnat Trainer	T.	24 0	30 9	1	Orpheus	4,230	7,200	40	nil	opt.	opt.	M=0.97	—	40,000	7	2hr 15
Gloster																
Javelin FAW.8	F.	52 0	57 0	2	Sapphire	n.r.	n.r.	n.r.	2 30	nil	4 Fsks.	700+	n.r.	n.r.	n.r.	n.r.
Javelin T.3	T.	52 0	60 2	2	Sapphire	n.r.	n.r.	n.r.	4 30	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Handley Page																
Victor B.1	B.	110 0	114 11	4	Sapphire	n.r.	n.r.	n.r.	nil	A.	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Victor B.2	B.	n.r.	n.r.	4	Conway	69,000	n.r.	n.r.	nil	A.	S.O.B.	n.r.	n.r.	n.r.	n.r.	n.r.
H.P.111	Tt.	130 0	137 8	4	Conway	74,000	240,000	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Hawker																
Hunter F.6	F.B.	33 8	45 3	1	Avon	10,000+	n.r.	n.r.	4 30	2 1,000	24 60 or 2 Fsks.	700+	n.r.	n.r.	n.r.	n.r.
Hunter Two-Seater	T.	33 8	48 10	1	Avon	10,000+	n.r.	n.r.	2 30	n.r.	n.r.	700+	n.r.	n.r.	n.r.	n.r.
P.1121	Strike	n.r.	n.r.	1	Gyron	20,000+	n.r.	n.r.	n.r.	A.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Hunting Percival																
Jet Provost T.3	T.	36 11	32 5	1	Viper ASV.8	1,750	7,050	33	2 0.303	8 25	8 60	330	30,000	20,000	11.4	310
Pembroke	Tt.T.	64 6	46 0	2	Leonides	1,100	13,500	33.7	nil	nil	nil	220	2,000	10,000	10.5	1,030
Miles																
Student 1	T.	29 2	30 9	1	Marboré 2	880	3,500	26	nil	nil	nil	293	20,000	10,000	6.8	327
Student 2	T.	29 2	30 9	2	Palas	700	3,500	26	nil	nil	nil	281	s.l.	20,000	16.8	400
Centurion 3	T.	29 2	31 6	1	RB. 108	2,010	4,000	27.8	opt.	opt.	opt.	351	20,000	10,000	4.1	488
Saunders-Roe																
S.R.53	R'ch.	25 1	45 0	2	Spectre+ Viper	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Scottish Aviation																
Pioneer CC.1	C.O.	49 9	34 5	1	Leonides 502	540	5,800	14.9	nil	nil	nil	145	1,500	—	—	800
Twin Pioneer CC.1	B.C.O.R.	76 6	45 3	2	Leonides 514	1,120	14,000	20.8	nil	2 1,000	nil	165	1,450	—	—	900
Short																
PD.18 Britannic 1	Tt.	142 3½	135 0	4	Proteus	17,780	183,500	88.5	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
S.C.1	R'ch.	23 6	24 5	5	RB.108	10,100(3)	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Vickers-Armstrongs																
Valiant BK.1	B.R.	114 4	108 3	4	Avon	40,000+	120,000+	n.r.	nil	A.	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Vickers-Supermarine																
Scimitar F.1	F.Strike	37 2	56 2	2	Avon	20,000+	n.r.	n.r.	4 30	A.	various	700+	n.r.	n.r.	n.r.	n.r.
Swift F.7	F.	36 1	42 3	1	Avon	n.r.	n.r.	n.r.	nil	nil	4 Fireflashes	n.r.	n.r.	n.r.	n.r.	n.r.

Abbreviations: A.=atomic capability; A.-S.=anti-submarine; B.=bomber; C.=communications; D.=target drone; E.W.=early warning; F.=fighter; Fsks.=Fire-streak missiles; I.=intruder; i.r.c.=initial rate of climb (ft/min); n.r.=not released; O.=observation; R.=reconnaissance; R'ch.=research or experimental aircraft; R.P.=rocket projectile; s.l.=sea level; S.O.B.="stand-off bomb"; T.=training; Tt.=transport. **Notes:** (1) For piston engines and turboprops power (in h.p.) is for take-off; for turbojets, thrust (in lb.) is static. (2) Bomb and R.P. loads are generally alternatives. (3) Only one engine, of 2,010 lb thrust, is used for propulsion.

BRITISH CIVIL AIRCRAFT 1958

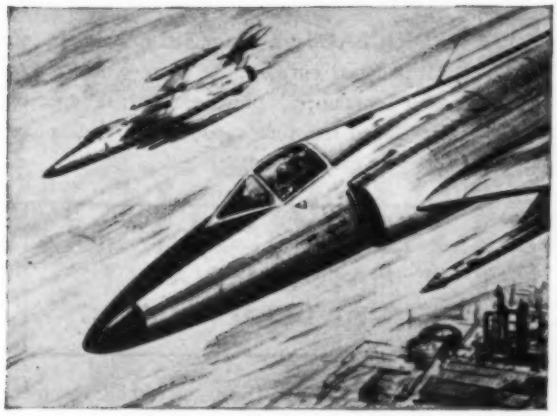
(INCLUDING TYPES NOT YET IN PRODUCTION)

Maker and Type	Span	Length	Wing Area	Powerplant			Gross Weight	Max. Pay-load	Max. Passenger Seats	Max. Fuel	Typical Performance				Balanced Field Length (note 3)
				No.	Type	Power (note 1)					Stage Length (note 2)	Height	Speed	Pay-load	
	ft in	ft in	sq ft				lb	lb		Imp. gal	n. miles	ft	m.p.h.	lb	ft
Armstrong Whitworth															
AW.650 Argosy	115 0	86 9	1,458	4	Dart 526 (note 4)	8,400	82,000	28,000	83	3,300	1,600	20,000	302	21,000	4,080
AW.670 Airbus	115 0	86 9	1,458	4	Dart 526 (note 4)	8,400	82,000	28,000	126	3,300	518	10,000	276	28,000	4,080
Auster															
Agricola	42 0	28 0½	254.7	1	Cont. O-470-M2	240	3,675	1,400	1	24	218	1,000	101	1,400	555
Workmaster	36 0	23 7	185	1	Lycoming O-360A	180	2,550	950	1	32	—	—	88	—	500
Blackburn															
B.107	166 8	124 0	3,000	4	Tyne RTy.11	22,000	175,000	58,000	108	9,800	2,940	25,000	353	40,000	4,350
Bristol															
200	91 0	121 6	n.r.	3	Various (5)	36,000	120,000	21,000	99	n.r.	2,880	25,000	610	21,000	n.r.
Britannia 320	142 3½	124 3	2,075	4	Proteus 765	17,780	180,000	28,000	133	8,580	4,700	30,000	357	28,000	7,200
de Havilland															
Airco D.H.121	n.r.	n.r.	n.r.	3	RB.141	36,000	n.r.	n.r.	99	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Chipmunk 23	34 4	25 5	172	1	Gipsy Major 10	145	2,420	800+	nil	18	—	s.l.	82	—	1,400
Comet 4	115 0	111 6	2,121	4	Avon 524	42,000	156,000	19,124	81	8,990	2,720	40,000	500	19,124	6,700
Comet 4B	107 10	118 0	2,066	4	Avon 524	42,000	156,000	22,454	102	7,890	2,240	23,500	530	22,454	7,000
Comet 4C	115 0	118 0	2,121	4	Avon 524	42,000	156,000	23,209	102	8,990	2,270	40,000	500	23,209	6,700
Dove 5	57 0	39 3	335	2	Gipsy Queen 70 Mk 2	760	8,800	1,800	11	133	490	8,000	179	1,672	2,430
Heron 2	71 6	48 6	499	4	Gipsy Queen 30 Mk 2	1,000	13,150	3,050	17	316	400	8,000	183	3,050	2,595
Edgar Percival															
E.P.9	43 6	29 6	228	1	Lycoming GO-480	270	4,150	1,978	5	56	350	5,000	125	1,238	450
Handley Page															
Dart-Herald	94 9½	71 11	886	2	Dart 527	4,200	37,000	10,160	47	1,080	690	18,000	270	10,160	3,700
H.P.111	130 0	137 8	n.r.	4	Conway	74,000	240,000	n.r.	202	n.r.	3,800	n.r.	540	54,000	n.r.
Hunting															
H.107	80 0	77 9	800	2	Orpheus 810	10,400	41,500	10,960	48	2,160	1,050	—	461	10,960	4,800
President	64 6	46 0	400	2	Leonides 503	1,100	13,500	3,800	12	238	230	8,000	173	3,250	3,750
Jackaroo															
Jackaroo	30 4½	25 0	247	1	Gipsy Major 1	130	2,180	700	3	19	250	1,000	85	600	1,800
Miles															
H.D.M. 106 Caravan	75 4	37 10	279	2	Lyc. GSO-480B (6)	680	8,000	3,040	15	150	250	5,000	129	3,000	1,450
Scottish Aviation															
Twin Pioneer	76 6	45 3	657	2	Leonides 502	1,080	14,000	3,500	16	180	300	5,000	117	2,700	894
Short and Harland															
Britannic 1	142 3½	135 0	2,075	4	Proteus 255	17,780	183,500	50,000	120+	8,580	2,500	n.r.	330	36,000	n.r.
Vickers-Armstrongs															
Viscount 790	93 8½	81 10	963	4	Dart 506	6,168	61,500	12,500	65	1,916	1,000	20,000	312	12,500	4,850
Viscount 810	93 8½	85 8	963	4	Dart 525	7,960	69,000	15,054	74	1,916	985	20,000	365	15,054	5,550
Vanguard 2	118 0	122 10½	1,529	4	Tyne 2	22,100	141,000	29,000	139	5,100	2,550	20,000	425	29,000	6,000
VC.10	140 0	158 0	2,800	4	Conway	74,000	299,000	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.

Notes: (1) Powers are in b.h.p. (pistons), e.h.p. (turboprops), lb static thrust (jets). (2) Range with full fuel reserves. (3) With engine-cut at critical speed in case o multi-engine types. (4) Two R-R. Tynes as a later alternative. (5) RB.141, RA.29 or Olympus/Zephyr. (6) Unsupercharged version if required. n.r.—not released.

BRITISH HELICOPTERS 1958

Maker and Type	Main Rotors	Rotor Diam.	Fuse-lage Length	Power Unit(s)			Gross Weight	Disc Load-ing	Dispos-able Load	No. of Pass.	Typical Performance			
				No.	Type	Power					Range	Height	Speed	Pay-load
		ft in	ft in			h.p.	lb	lb/sq ft	lb		miles	ft	m.p.h.	lb
Bristol														
Type 171 (Sycamore)	1	48 7	42 0	1	Leonides 73	515	5,400	2.87	1,340	3/4	270	s.l.	91	706
Type 192	2	48 8	54 4	2	Gazelle	2,600	18,000	4.83	—	23 troops	149	—	138	3,250
Fairey														
Rotodyne	1	90 0	58 8	2	Eland	7,000	39,000	6.14	15,500	40/48	400	—	185	7,000
Ultra-light	1	28 3	14 8	1	Palouste	258	1,800	2.87	843	1	100	s.l.	95	450
Saunders-Roe														
P.531	1	32 6	29 0	1	Turmo 600	425	3,800	4.94	1,708	4	210	—	115	700
Skeeter Mk 12	1	32 0	23 5	1	Gipsy Major 215	215	2,200	2.86	544	1	190	—	100	350
Westland														
Wessex	1	56 0	49 11	1	Gazelle NGa.13	1,400	12,600	5.1	5,000	12	390	—	120	2,700
Whirlwind 5	1	53 0	42 0	1	Leonides Major	750	7,800	3.5	2,530	10 troops	200	—	86	1,700
Whirlwind 7	1	53 0	42 0	1	Leonides Major	750	7,800	—	—	—	250	s.l.	86	1,500
Widgeon	1	49 2	41 3	1	Leonides 521/1	515	5,900	3.11	1,578	4	100	—	81	1,000
Westminster (transport)	1	72 0	65 0	2	Eland 229	—	33,000	8.09	13,000	43 troops	180	—	150	9,925



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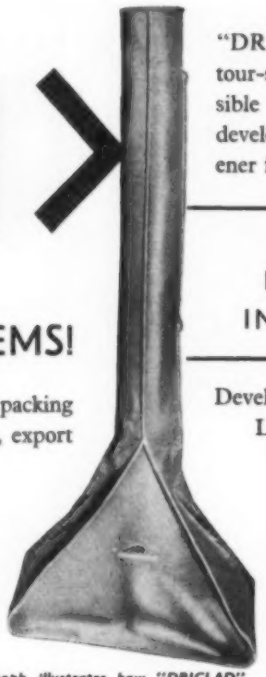

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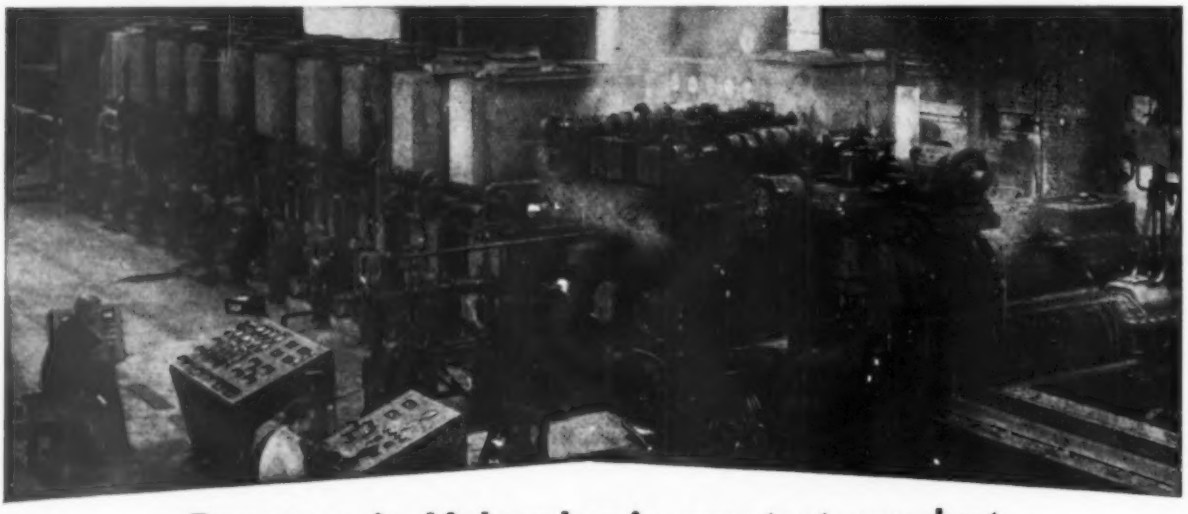

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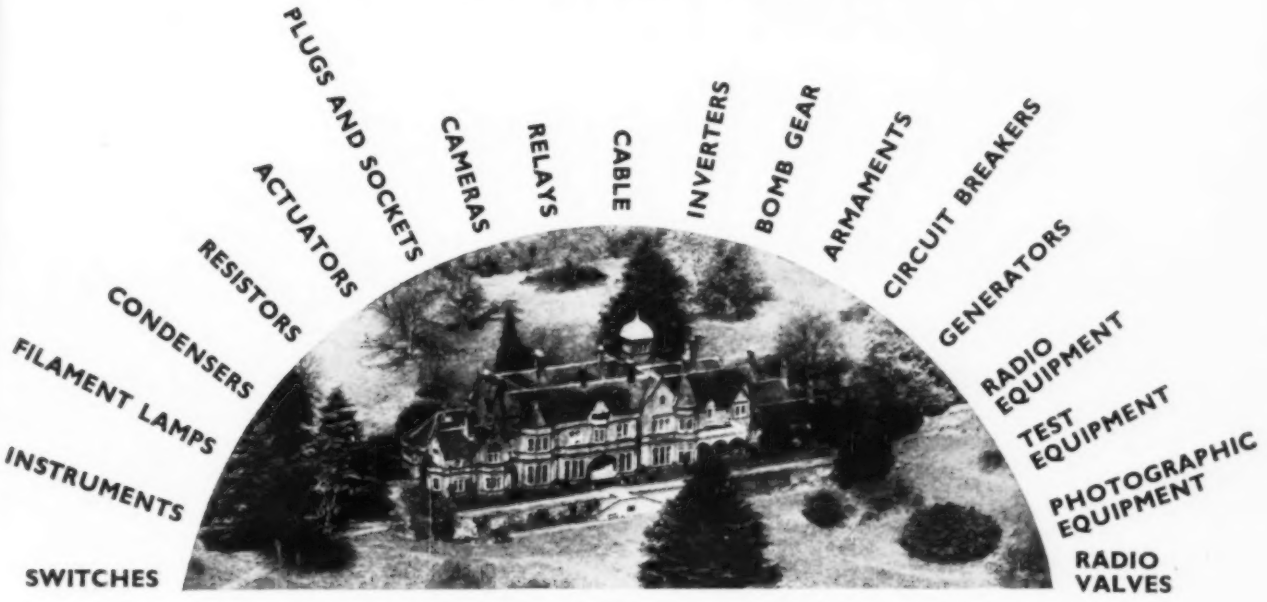

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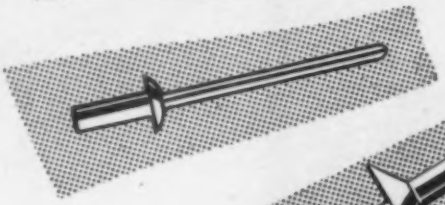

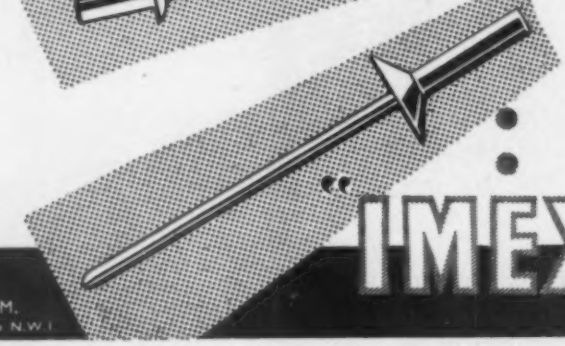

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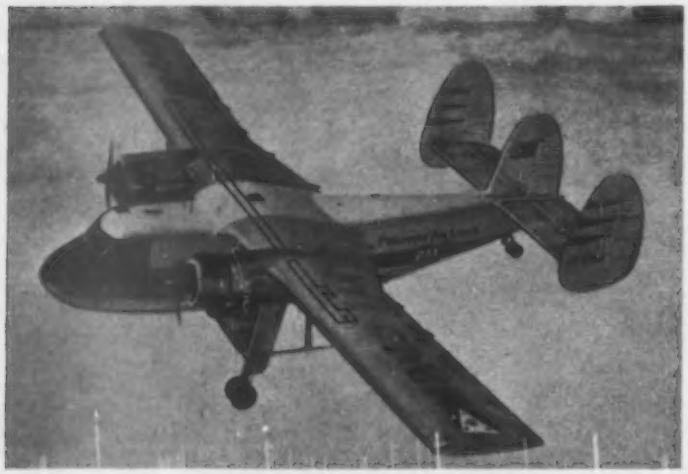

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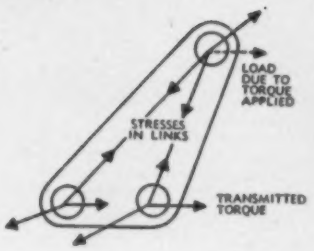

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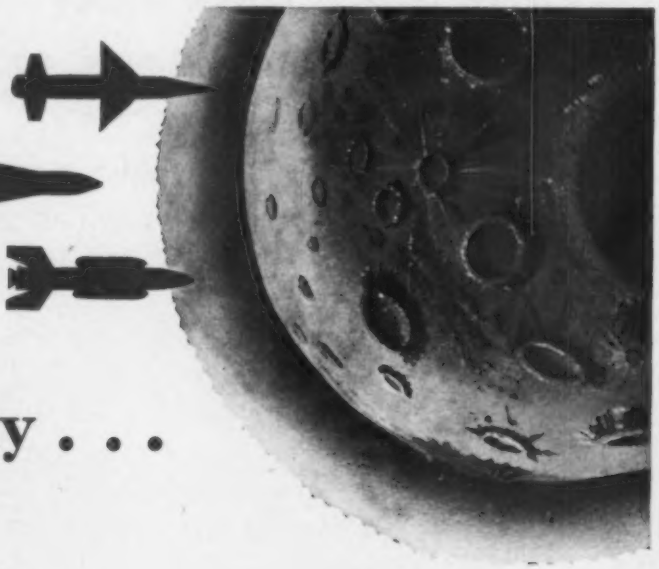

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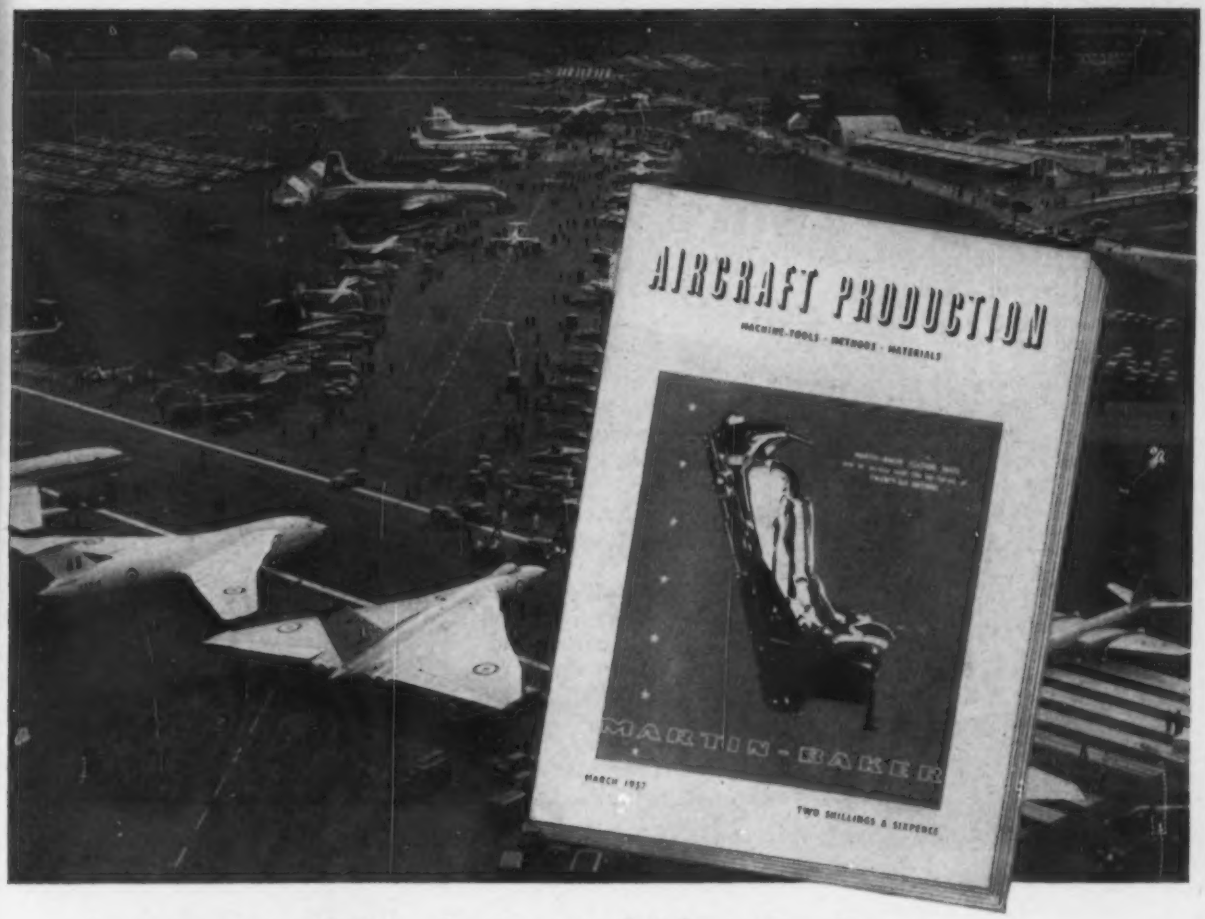

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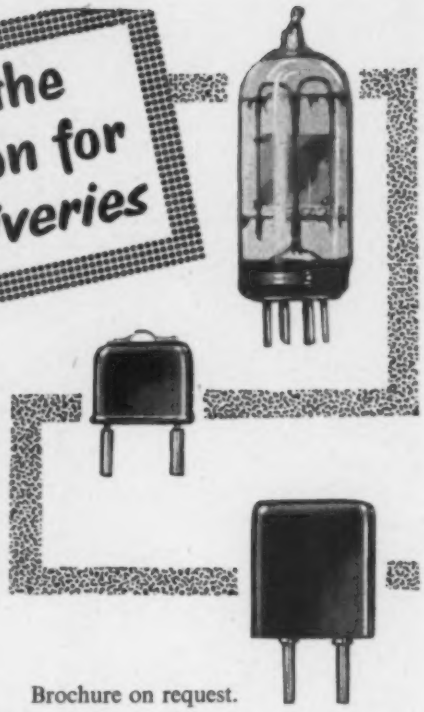

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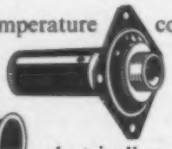

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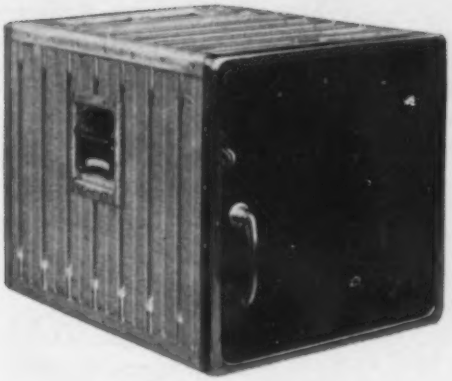

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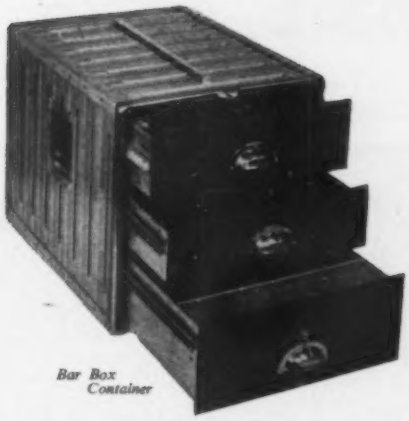

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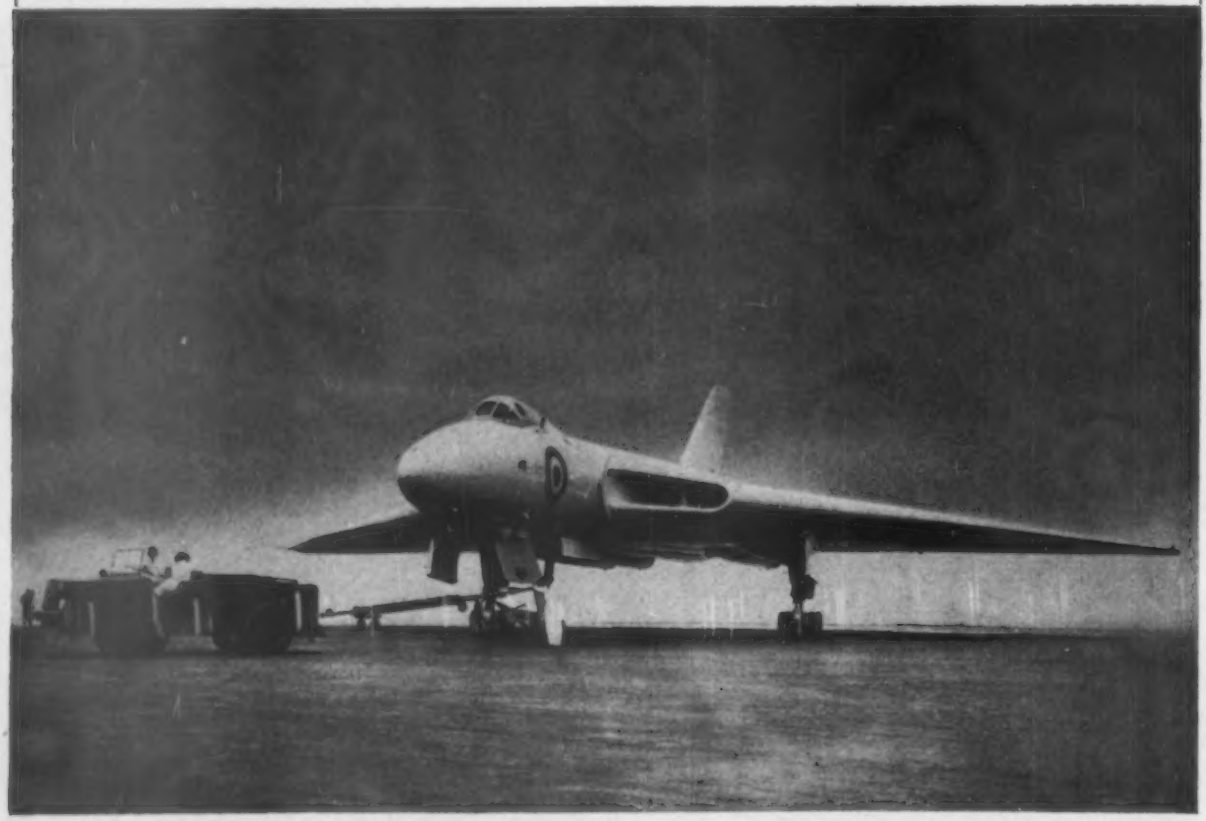

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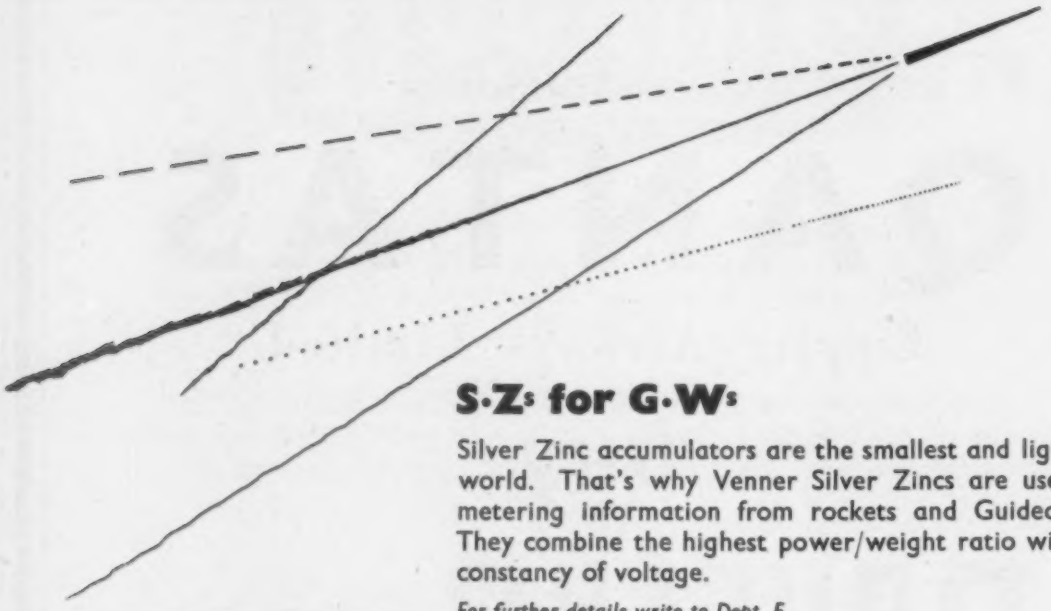

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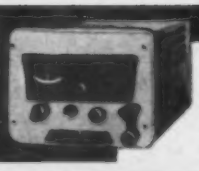

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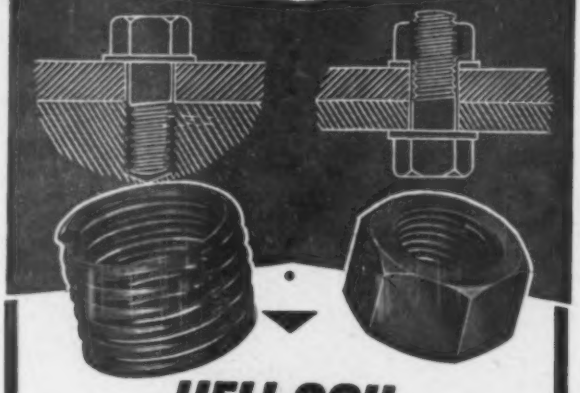

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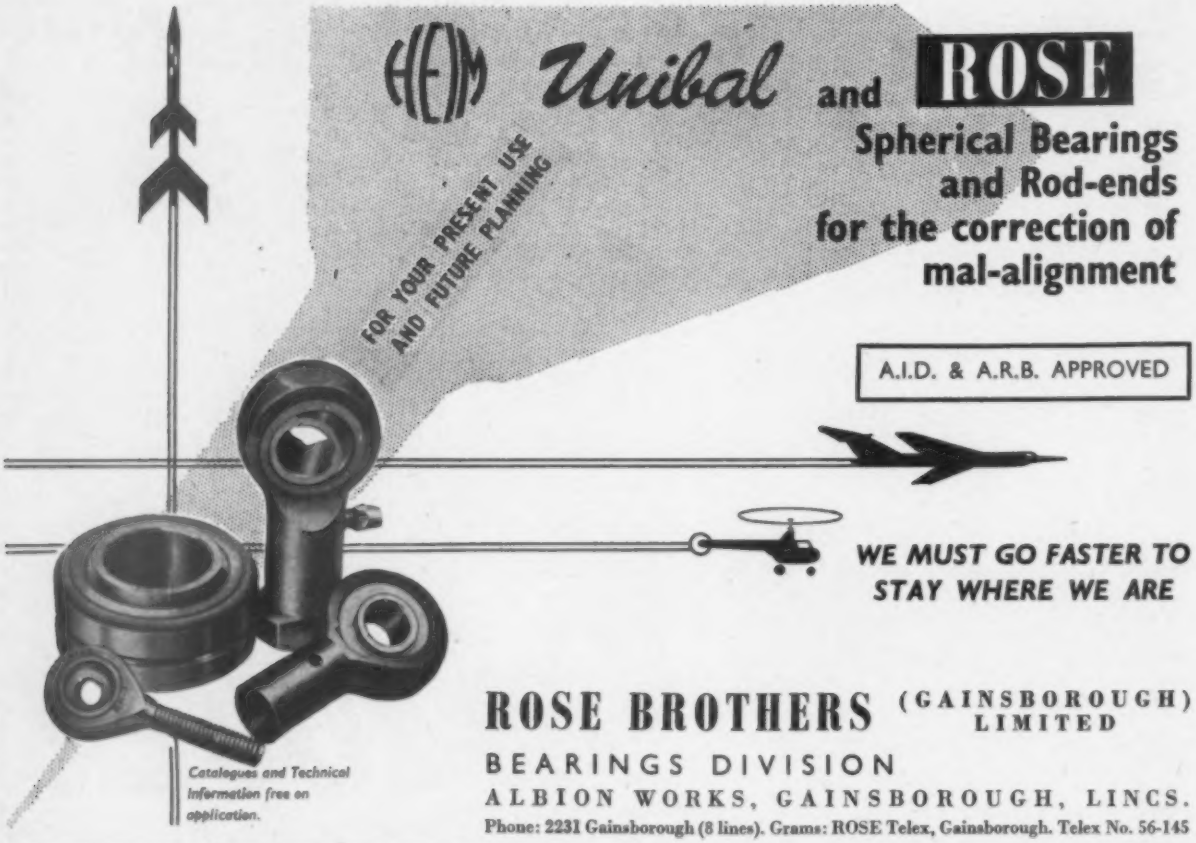

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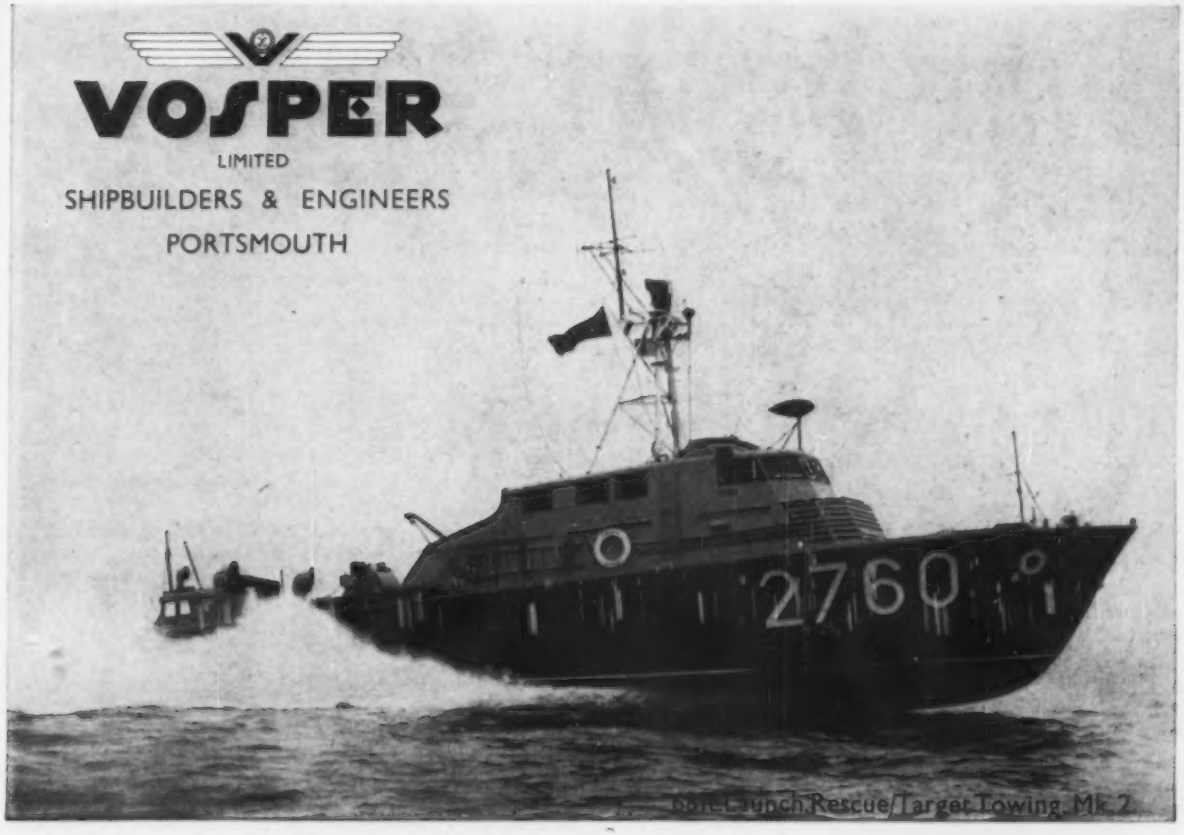

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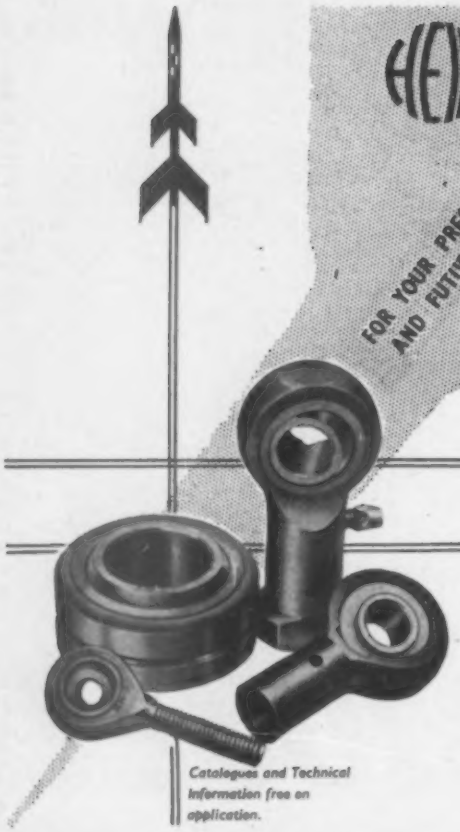

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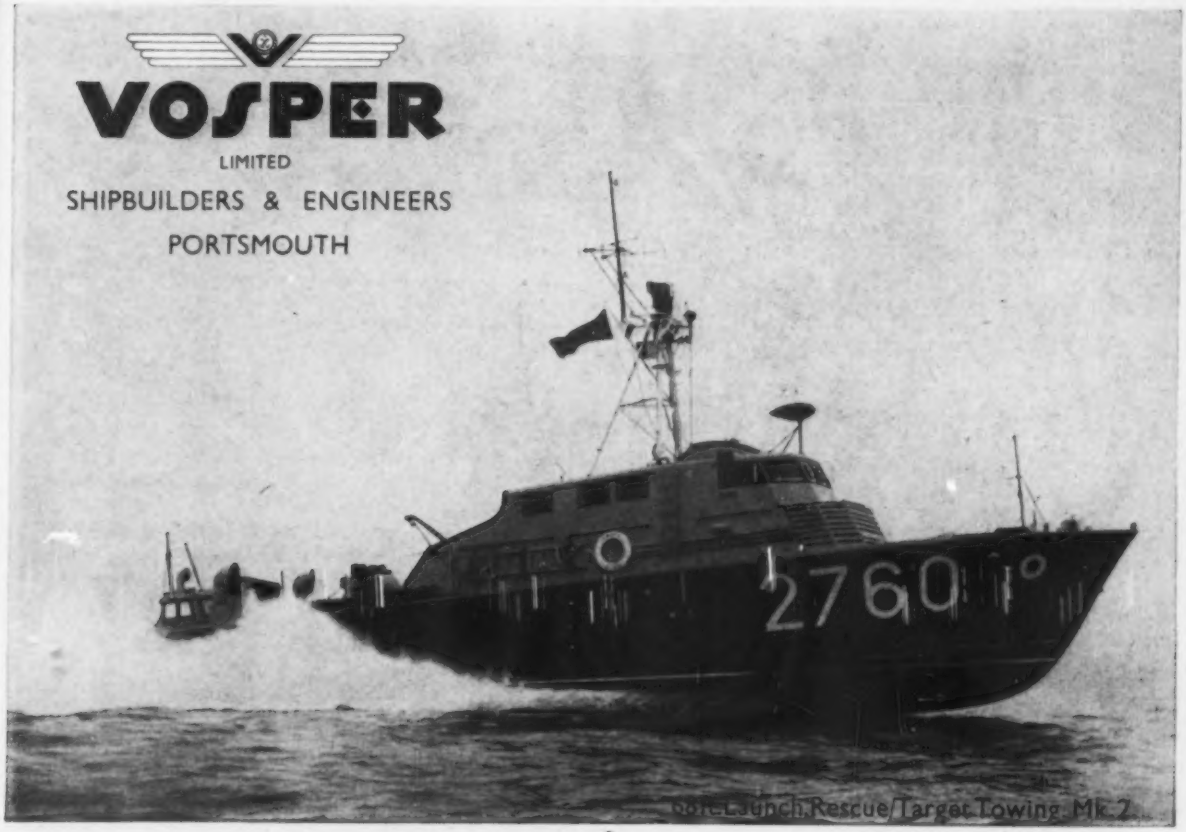

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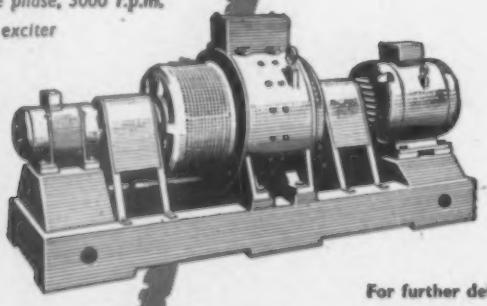

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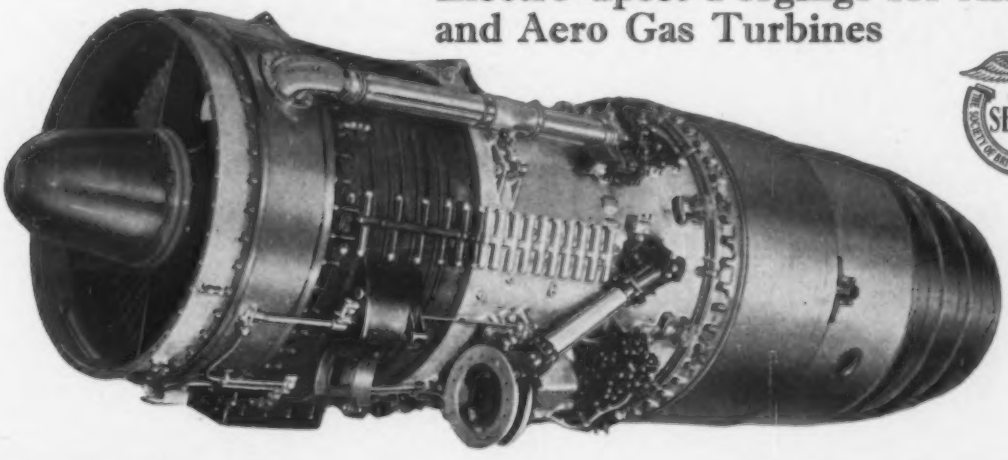

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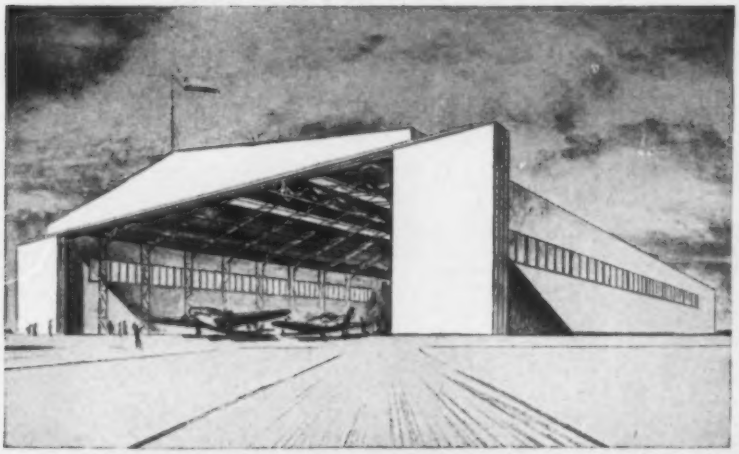

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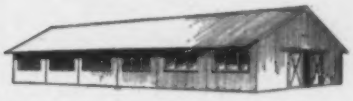

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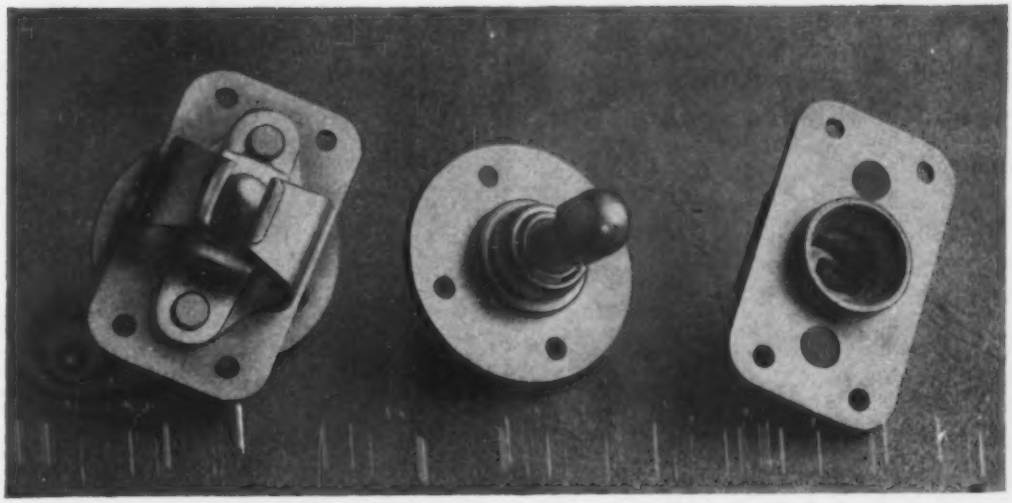

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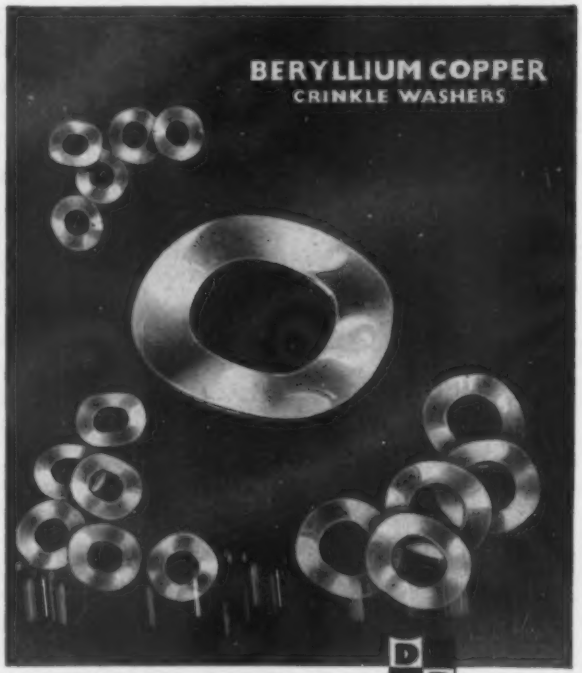

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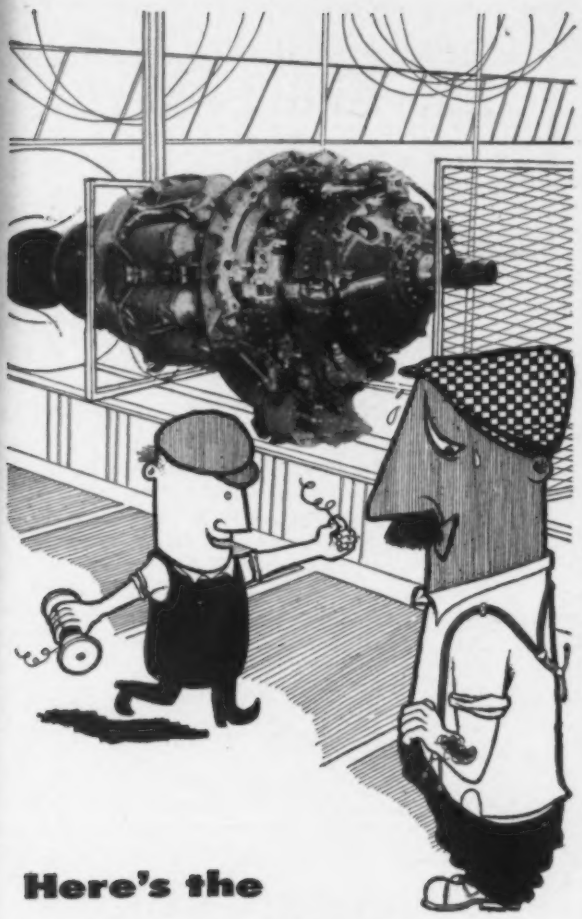

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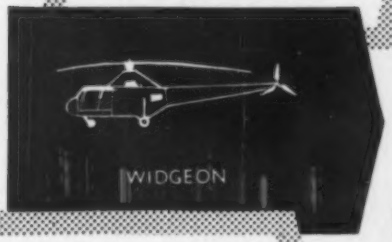

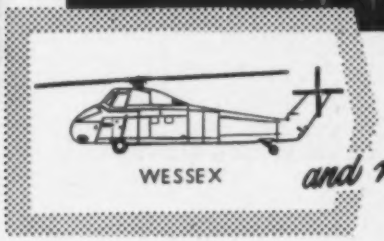

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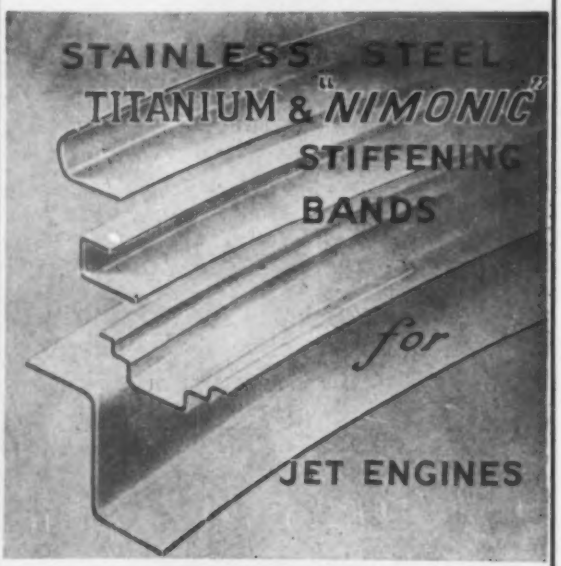

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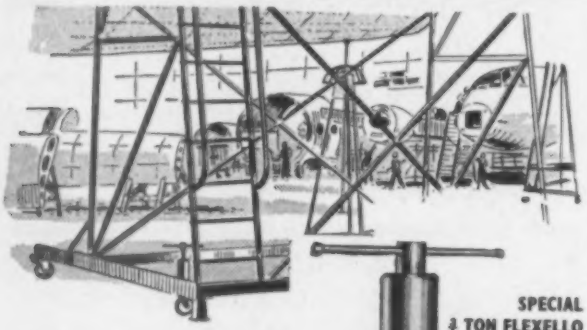

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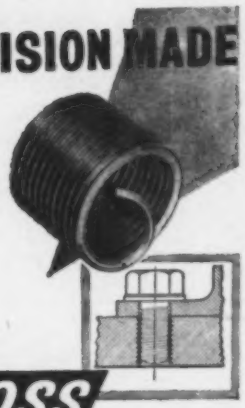

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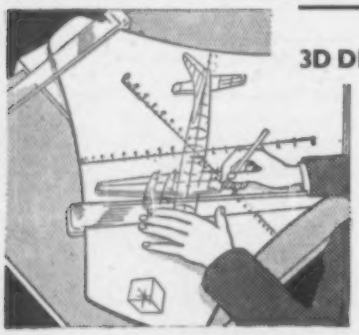

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INDEX TO ADVERTISERS

	Page
Abbey Engineering Co. (Coventry), Ltd., The	184
Abbey Panel and Sheet Metal Co., Ltd.	53
Acratork Engineering Co., Ltd.	178
Adam and Lane and Neeve, Ltd.	192
Aero Controls, Ltd.	170
Aerolex, Ltd.	169
"Aircraft Production"	171
Aircraft Unit Engineering Co.	176
Airwork, Ltd.	21
Air Trainers Link, Ltd.	20
Alvis, Ltd.	Facing Edit. Page 327
Amalgamated Wireless (Australasia), Ltd.	43
Ansor Corporation	166
Anticoustic Co., The	208
Armstrong Patents Co., Ltd.	182
Armstrong Whitworth Aircraft, Ltd., Sir W. G.	72, 133
Attewell and Sons, Ltd., B.	204
Automotive Products Co., Ltd.	Facing Edit. Page 374
Aylesbury Turned Parts (True Screws), Ltd.	202
Baines, Ltd., C. O. H.	66
B.B. Chemical Co., Ltd.	Cover iii
Bellman Hangars, Ltd.	189
Bell Precision Engineering Co., Ltd.	182
Birfield Industries, Ltd.	35
Birkett, Billington and Newton, Ltd.	179
Blackburn and General Aircraft, Ltd.	124, 137
B.M.B. (Sales), Ltd.	6
Boorn and Co., Ltd., Thos.	167
Boulton Paul Aircraft, Ltd.	47, 207
B.P. Aviation Service	51
Bradley, Ltd., G. and E.	181
Bramah and Co., Ltd., J. R.	168
Brand and Co., Ltd., R. A.	156
Bristol Siddeley Engines, Ltd.	127, Cover iv
British Aluminium Co., Ltd., The	25
British Aviation Insurance Co., Ltd., The	188
British Manf. and Research Co., Ltd.	Between Edit. Pages 374/5
British Oxygen Gases, Ltd.	206
British Refrasil Co., Ltd., The	197
British Thomson-Houston Co., Ltd., The	157
British Timken, Ltd.	Cover ii
Brooklands Aviation, Ltd.	198
Brown, Ltd., S. G.	24
Brown Construction Equipment, Ltd., David	56
Brush Crystal Co., Ltd.	172
Bryans Aeroquipment, Ltd.	199
B.S.T. Aeronautical Co., Ltd.	193
Burgess and Co., Ltd., G. N.	202
Burnley Aircraft Products, Ltd.	70
Carlisle and Co., Ltd., C. G.	65
Ceag, Ltd.	176
Cellon, Ltd.	Between Edit. Pages 374/5
Chelton (Electrostatics), Ltd.	198
Cinetra	201
C.J.C. Development (Portsmouth), Ltd.	68
Connolly Brothers (Curriers), Ltd.	134
Coopers Mechanical Joints, Ltd.	182
Copeland and Jenkins, Ltd.	202
Cornercroft, Ltd.	59
Cory Brothers and Co., Ltd.	57
Costain, Ltd., Richard	185
Cox and Son, Ltd., John	198
Cross Manufacturing Co. (1938), Ltd.	204
Curran, Ltd., John	30
C.W.C. Equipment, Ltd.	4
Dawe Instruments, Ltd.	50
Decca Navigator Co., Ltd., The	Facing Edit. Page 322
De Havilland Enterprises, The	Between Edit. Pages 354/5
Delaney Gallay, Ltd.	135 Between Edit. Pages 374/5
Derby Aviation, Ltd.	203
Docker Brothers	Between Edit. Pages 338/9
Douglas Equipment, Ltd.	174, 175
Dowty Fuel Systems, Ltd.	Between Edit. Pages 326/7
Dunlop Rubber Co., Ltd.	Between Edit. Pages 330/1
Durion, Ltd.	200
Dzus Fastener, Europe, Ltd.	164
Eastern Aero Electrical Services, Ltd.	177
Elliott Brothers (London), Ltd.	60
E.M.C. Engineering Co. (London), Ltd.	200
English Electric Co., Ltd., The	206
English Electric Group	Between Edit. Pages 302/3
E.N.V. Engineering Co., Ltd.	32
Equator Wheels and Sections, Ltd.	196
Esso Petroleum Co., Ltd.	Between Edit. Pages 326/7
Export Packing Service, Ltd.	158
Fairey Aviation Co., Ltd., The	Between Edit. Pages 306/7
Feltham, Ltd., Walter H.	204
Ferranti, Ltd.	37
Fibreglass, Ltd.	144
Fireproof Tanks, Ltd.	168
Firestone Tyres and Rubber Co., Ltd.	Between Edit. Pages 338/9
Firth and John Brown, Ltd., Thos.	5
Firth-Vickers Stainless Steels, Ltd.	10
Fishers	204
Flexello Castors and Wheels, Ltd.	198
Flight Equipment and Engineering, Ltd.	180
Folland Aircraft, Ltd.	126
Garringtons, Ltd.	Facing Edit. Page 338
General Electric Co., Ltd., The	162, 170
Gloster Technical Developments	76
Godfrey and Partners, Ltd., Sir George	193
Goodyear Tyre and Rubber Co. (Great Britain), Ltd., The	139
G.Q. Parachute Co., Ltd.	69
Graseby Instruments, Ltd.	Facing Edit. Page 319
Graviner Manufacturing Co., Ltd.	27
Habershon and Sons, Ltd., J. J.	160
Hall and Sons (Bristol and London), Ltd., John	158
Handley Page, Ltd.	125
Hawker Aircraft, Ltd.	Between Edit. Pages 326/7
Hawker Siddeley Group	Between Edit. Pages 314/5
Helicopter Sales, Ltd.	46, 204
Henshall and Sons (Addlestone), Ltd., W.	173
Hepworth and Grandage (Yeadon), Ltd.	Between Edit. Pages 344/5
High Duty Alloys, Ltd.	Between Edit. Pages 326/7
High Pressure Components, Ltd.	19
HML (Engineering), Ltd.	23
Hobson, Ltd., H. M.	11, 207
Hordern-Richmond, Ltd.	159
Hunting Aircraft, Ltd.	Between Edit. Pages 344/5
Hymatic Engineering Co., Ltd., The	13
Iliffe and Sons, Ltd.	171, 179
Imperial Chemical Industries, Ltd.	26
Integral, Ltd.	195
Irving Airchute of Great Britain, Ltd.	128
Iso-Speedic Co., Ltd., The	40
Jeppesen and Co., G.m.b.H.	186
Jenks Brothers, Ltd.	190
Jessop and Sons, Ltd., William	29
Kautex, Ltd.	199
Kelston Engineering Co., Ltd., The	178
Kidde Co., Ltd., Walter, The	28
Kigass, Ltd.	184
Kiveton Park Steel and Wire Works, Ltd.	194
Lancefield Aircraft Components, Ltd.	197
Latex Upholstery, Ltd.	191
Light Soldering Developments, Ltd.	205
Lockheed Aircraft Corporation	165
London School of Air Navigation	204
Lucas (Gas Turbine Equipment), Ltd., Joseph	Between Edit. Pages 326/7
Luton Airways, Ltd.	204
Marconi's Wireless Telegraph Co., Ltd.	41, 42, 44 Facing Edit. Page 303
Marston Excelsior, Ltd.	55
Martin-Baker Aircraft Co., Ltd.	Facing Edit. Page 340
Mavitta Drafting Machines, Ltd.	206
Metachemical Processes, Ltd.	177
Microcell, Ltd.	138
Mills, Ltd., William	58
M. L. Aviation Co., Ltd.	183
Mollart Engineering Co., Ltd., The	192
Murex Welding Processes, Ltd.	136
Murphy Radio, Ltd.	194
Napier and Son, Ltd., D.	Between Edit. Pages 302/3
National Aeronautical Corporation	180
Negretti and Zambra, Ltd.	156
Newalls Insulation Co., Ltd.	64
Newmark, Ltd., Louis	71
Newton Brothers (Derby), Ltd.	186
Nord-Aviation	16
Northern Aluminium Co., Ltd.	48, 49
Oddie, Bradbury and Cull, Ltd.	189
Omes, Ltd.	187
Omnipol, Ltd.	196
Opperman, Ltd., S. E.	196
Page Engineering Co.	140
Palmer Aero Products, Ltd.	1
Park, Ltd., R. and J.	188
Peto and Radford	141
Phillips and White, Ltd.	154
Plannair, Ltd.	142
Plessey Co., Ltd., The	Facing Edit. Page 344
Powis and Sons, Ltd., David	190
Precision Rubbers, Ltd.	160
Presland and Ptnrs., Ltd.	200
Pullin and Co., Ltd., R. B.	181
Pulsometer Engineering Co., Ltd.	34
Pyrene Co., Ltd., The	163
Rapp, Ltd., Leo	186
Ransome and Marles Bearing Co., Ltd.	36
Redifon, Ltd.	153
Reid and Sigrist, Ltd.	22
Rellumit (London), Ltd.	8
Reynolds T.I. Aluminium, Ltd.	Between Edit. Pages 338/9
R.F.D. Co., Ltd.	31
Rist's Wire and Cables, Ltd.	Facing Edit. Page 375
Rivers, Ltd., A. E.	201
R.M.R. Engineering	200
Robinson and Co. (Gillingham), Ltd., L.	9
Roe and Co., Ltd., A. V.	Cover i
Rollason Aerocessories, Ltd.	38
Rolls-Royce, Ltd.	73
Rose Brothers (Gainsborough), Ltd.	184
Rotax, Ltd.	123, Between Edit. Pages 344/5
Rotol/British Messier, Ltd.	155, Facing Edit. Page 326
Royal Dutch Shell Group	207
Rozalex, Ltd.	205
Rubery Owen and Co., Ltd.	17
Rumbold and Co., Ltd., L. A.	187
Sangamo Weston, Ltd.	157
Savage, Ltd., W. Bryan	18
Saunders-Roe, Ltd.	Facing Edit. Page 318
Saunders Valve Co., Ltd.	Between Edit. Pages 338/9
Scottish Aviation, Ltd.	Facing Edit. Page 307
Serck Radiators, Ltd.	62
Shackleton, Ltd., W. S.	203
Short Brothers and Harland, Ltd.	15
Siebe Gorman and Co., Ltd.	188
Simmonds Aerocessories, Ltd.	45
Smith-Clayton Forge, Ltd.	14
Smiths Aircraft Instruments, Ltd.	143
Solartron Electronic Group, Ltd., The	Facing Edit. Page 323
Soundrite, Ltd.	192
Spa Guilds, Ltd.	178
Sperry Gyroscope Co., Ltd.	Between Edit. Pages 326/7, 374/5
Spring Washers, Ltd.	198
Stainless Steel Wire Co., Ltd.	191
Standard Telephones and Cables, Ltd.	2, 3
Steel Stampings, Ltd.	180
Sterling Metals, Ltd.	39
Stewart Aeronautical Supply Co., Ltd.	161
Stone and Co. (Charlton), Ltd., J.	33
Stream-Line Filters, Ltd.	61
Stuart (London), Ltd., Robert	201
Super Oil Seals and Gaskets, Ltd.	Between Edit. Pages 338/9
Technical Platings, Ltd.	202
Teddington Aircraft Controls, Ltd.	7, 172
Thermal Control Co., Ltd.	190
Thompson Brothers (Bilston), Ltd.	54
Titanine, Ltd.	12
Transport Equipment (Thornycroft), Ltd.	67
Transport Seating, Ltd.	194
Triplex Safety Glass Co., Ltd.	195
Tucker Eyelet Co., Ltd., Geo.	166
Tungum Co., Ltd., The	162
Ultra Electric, Ltd.	74
Valay Industries, Ltd.	183
Varley Dry Accumulators, Ltd.	Facing Edit. Page 306
Venner Accumulators, Ltd.	176
Vickers-Armstrongs (Aircraft), Ltd.	75
Vosper, Ltd.	185
Western Manufacturing (Reading), Ltd.	63
Westland Aircraft, Ltd.	Facing Edit. Page 341
Whitehouse Industries, Ltd.	Facing Edit. Page 339
Williamson Manufacturing Co., Ltd.	52
Wilmot Breeden, Ltd.	Between Edit. Pages 338/9
Wilson and Sons (London), Ltd., W.	164
"Wireless World"	179
W. S. Electronics (Production), Ltd.	154

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